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ABSTRACT

This report documents historically the impact of postsecondary forestry and forest-products educational programs in the southern United States. Samples of programs described concentrate on programs that appear to have had an effect on the economy, the resource, or policy. The report discusses the impacts of two types of institutions: the 16 southern universities and colleges offering professional degree programs at the bachelor's or higher levels in forestry and forest-products fields; and 14 community colleges, junior colleges, and other institutions offering 2-year programs at the associate degree level. The report discusses organization of the programs, fields offered, cooperative relationships, program impacts, resident instruction, contribution to the South's professional work force, development of university programs, unique professional degree programs, production of top leaders, training programs for forestry and forest-products technicians, research, case examples of benefits from university research, extension programs, continuing education, and public service. A list of 57 cited published sources, 24 cited unpublished sources, and 60 interviews and letters concludes the report. (JDD)

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The Forest Service, in collaboration with State forestry agencies, forestry schools, forest industries, and other forestry interests, has prepared a comprehensive analysis of the timber situation in the 12 Southern States—Forest Resource Report 24, "The South's Fourth Forest: Alternatives for the Future." This handbook is one of several supplements to that document.

"The South's Fourth Forest" is available for purchase from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, in both paperbound and microfiche.

United States
Department of
Agriculture

Forest Service

Washington, DC

October 1988

Growth of Southern Higher Education Forestry Programs and Their Impact on the South's Timber Resources and Industries

By John Gray[1]

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The Forest Service, Cooperative State Research Service, and Extension Service are agencies within the U.S. Department of Agriculture (USDA).

I believe it was historian John Toland who observed, "Even the most scrupulously researched history can only be an approximation of the truth."

Certainly that description applies to this "history" for several reasons. First, this report documents historically the *impact* of post-secondary forestry and forest-products educational programs in the South. Thus it is far from a comprehensive organizational, legislative, programmatic, or leadership account. I have concentrated primarily on programs that appear to have had an effect on the economy, the resource, or policy. And in the interest of brevity, I have included only samples of these to give the reader a feel for their diversity and magnitude.

Second, there are some gaps in the material. I had to omit one university's contribution completely because I did not have time to visit it for interviews and got no response to a mail inquiry. I have shortchanged another which did respond by mail, but which I did not have time to visit. Consequently, my reference material was much more limited than for the 14 universities and 2 technician schools where I did have an opportunity to interview leaders and faculty.

Finally, this account is not without bias. Personal contacts to collect material were almost altogether with the "producers" in the system—faculty and administrators—rather than the "consumers"—employers, forest owners, plant managers. I have tried to avoid "hype" on their part and mine in tracing out the contributions of the southern universities and technician schools to the development and productivity of the southern forest resource and forest-products industry. But presenting a thoroughly objective account is difficult for someone who invested 18 years in helping develop an extension program in one Southern State and nearly 14 more in a professional school program in another. One might as well expect Jefferson Davis to write an unbiased account of "The War of Northern Aggression," which is undoubtedly the title he would have given to it. As E. B. White (1977) put it so admirably, "All writing slants the way the writer leans, and no man is born perpendicular, although many men are born upright."

Acknowledgments

So many people contributed to this manuscript that it would be hard to list them all. For written reference material I am particularly indebted to that historian of forestry historians, the late Henry Clepper; to Frederick Deneke, Donald Nelson, and Claude Bennett, all of the USDA Extension Service; to Boyd Post, USDA Cooperative State Research Service; to the Washington, DC, staff of Robert Buckman, recently retired Deputy Chief for Research, USDA Forest Service; to information officers of the National Association of State Universities and Land Grant Colleges, Washington; to Jim Neal, Southern Regional Extension Forester, Athens, GA; to James Montgomery and Don Smith, Southern Forest Institute, Atlanta; to Jack Warren, Forest Farmers Association, Inc., also of Atlanta; and to the Forest History Society of Durham, NC.

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I particularly appreciate the time and effort of six reviewers—Dennis Roth and Dwight Hair of the Forest Service, Washington, DC; Arnett C. Mace, Jr., Director, School of Forest Resources and Conservation, University of Florida, Gainesville; J. Charles Lee, Head, Department of Forest Science, Texas A. & M. University, College Station; Jim Neal, Southern Regional Extension Forester, Athens, who reviewed the material on extension; and Leonard Hampton, Director, Georgia Center for Continuing Education, Athens, who reviewed the material on continuing education.

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John Gray
Little Rock, AR
August, 1985

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Fifty years ago the Society of American Foresters conducted its first evaluation and accreditation of professional forestry educational programs in the United States. Programs at 20 universities and colleges were rated. Only three of these were in the South—at the University of Georgia, Louisiana State University, and North Carolina State College of Agriculture and Engineering (now North Carolina State University).

The Society evaluated each institution's program on seven criteria, giving a numerical rating for each. A minimum score of 70 was required for the program to fall in the Society's "approved" category. Graduates of approved programs were eligible automatically for junior membership status in the Society; graduates of other programs had to prove that they had equivalent knowledge in order to qualify.

In 1935, a total of 14 programs qualified for the "approved" list. None were in the South (Chapman 1935).

At that time the Society did not examine programs for the training of forest technicians. In fact, no such programs were operating in the Southern States in 1935, although one was started in that year at the University of Florida (Dana and Johnson 1963).

As of 1985, there are 46 accredited professional forestry educational programs in the Nation. Fifteen are in southern universities: each of the 12 Southern States has at least one such program, and 3 of them have two (Elliott 1985). As a region, the South not only has more than its numerical share of such programs, but two recent rankings of program quality and productivity indicate respectable ratings in these characteristics as well. An unpublished comparison of 44 accredited professional forestry degree programs (the total number in 1984), which was based on opinions by the administrators of such programs, placed 6 southern programs in the top 19. Three were placed in the top five (Thomson and Koenig [n.d.], post 1982).

In 1982, the USDA Cooperative State Research Service produced a research productivity analysis of 60 land-grant institutions, other public universities, and State agricultural experiment stations receiving Federal funds for forestry research under the McIntire–Stennis Cooperative Forestry Research Act of 1962. The rating for each institution was based on a combined ratio of the 5-year averages of publications per scientist and graduate students directed per scientist. Of the 19 institutions with 5-year combined ratios of at least 2.0, four were southern land-grant universities (USDA Cooperative State Research Service 1982 unpubl.).

Thus in forestry and forest technology higher education, over the past 50 years the South truly has risen again.

The Southern Higher Educational System in Forestry and Forest Products

This report will be limited to discussing the impacts of two major types of institutions involved in postsecondary education in forestry and forest products in the South:

- Universities and colleges offering professional degree programs at the bachelor's or higher levels in forestry and forest-products fields. "Forest-products fields" includes programs carrying identifications such as "forest engineering," "industrial forestry operations," "forest products," "wood science and technology," and "pulp and paper science and technology."

- Community colleges, junior colleges, and other institutions offering 2-year programs at the associate degree level in forest technology, forest-engineering technology, and forest-products technology. These are often called ranger schools or technical schools (Warren and Wiseman 1985).

Professional-Level Institutions

In early 1985, 16 universities in the South offered professional-level degree programs in forestry, or forestry plus one or more forest-products fields. Three types of institutions were represented: State-supported 1862 land-grant universities (12), non-land-grant universities (3), and private institutions (1).

The distinction is important because of differences in roles and orientation. The 1862 land-grant universities have mandates and receive Federal funds on a matching basis under various congressional acts to contribute to the progress and welfare of their individual States through research and extension functions—particularly (but not exclusively) in agriculture, including forestry and forest products. Thus, in addition to the general mission of all senior universities, they have specific authorizations and responsibilities for the progress and development of agriculture and forestry in their home States (Beale 1974).

Of the 16 universities, 15 are engaged in the following functions:

- Resident instruction of professionals and scientists. All offer the first professional degree in forestry, and their programs meet accreditation standards of the Society of American Foresters. Ten of these also offer professional majors or options in one or more forest-products fields. Thirteen offer graduate training at the master's level, and 11 of these conduct doctoral-level instruction as well.
- Research.
- Continuing education.
- Public service through providing expert advice on forestry and forest-products science, technology, programs, and policies. In some institutions

private consulting by faculty is significant as well.

The 16th institution—McNeese State University—is the only one not multifunctional. Here faculty are involved only in resident instruction at the bachelor's degree level and in a forest-technology program (Kitt, personal communication). McNeese State is the only one of the 16 whose professional degree program in forestry had not been accredited as of early 1985 by the Society of American Foresters (Elliott 1985).

The 12 land-grant universities have an important fifth function—extension work. The Smith–Lever Act of 1914 created a national–State–county system to extend new research and other useful knowledge from such universities to farmers and others not in residence who could apply it to advantage. In the case of forestry and forest products, this transfer of technology is done with and through the State Cooperative Extension Service—a three-way partnership between the U.S. Department of Agriculture, the State land-grant university, and county governments (National Association of State Universities and Land-Grant Colleges 1978).

Duke University is the only private institution involved in professional forestry education in the South. It is also unique in offering only graduate degree programs with the Master of Forestry as the first professional degree (Smith 1984).

Table 1 lists the 16 institutions (in order of year the school first granted professional forestry degrees) and certain major characteristics of each (Warren and Wiseman 1985). The table does not include the University of the South at Sewanee, TN, which conducted a professional forestry degree program in the past but was no longer doing so in 1985. It lists only degrees granted by the forestry or forest-products academic unit. Thus, it understates the full scope of graduate education for institutions where forestry or forest-products faculty supervise graduate students in departments of related fields where the thesis research involves a forestry or forest-products problem or application.

Technician-Level Institutions

As of early 1985, 13 public institutions in 9 of the 12 Southern States conduct technician-training programs in forest technology. Haywood Technical College also conducts a forest-products technology program, and Lake City Community College has a program in forest-engineering technology. A fourteenth (Orangeburg–Calhoun Technical College) offers forest-products technology only (Moser 1985 unpubl.; Knudsen, personal communication).

Table 1—Professional forestry and forest-products educational programs in the South as of 1985 (in order of year of first graduation)

Parent institution	Type [1]	Forestry and forest-products academic units [2]	Year first professional degree awarded	Forestry majors and options offered [3]	Forest-products majors and options offered	First professional degrees offered [4]	Graduate degrees offered [5,6]
University of Georgia	SL-G	School of Forest Resources	1912	Forest resources Timber management and utilization Forest resources planning and administration Forestry sciences		B.S. in forest resources	M.F.R. [7] M.S. Ph.D.
Louisiana State University	SL-G	School of Forestry and Wildlife Management	1926	Forestry		B.S. in forestry	M.S. Ph.D.
North Carolina State University	SL-G	School of Forest Resources Department of Forestry Department of Wood and Paper Science	1930	Forestry	Pulp and paper science and technology	B.S. in forestry B.S. in pulp and paper science and technology	M.F. M.W.P.S.
					Wood science and technology	B.S. in wood science and technology	M.S. Ph.D.
Duke University	P	School of Forestry and Environmental Studies	1939	Forestry Forest productivity Forest management science		M.F.	M.F. M.A. M.S. Ph.D.

University of Florida	SL-G	School of Forest Resources and Conservation Department of Forestry	1939	Forestry		B.S. in forest resources and conservation	M.F.R.C. M.S. Ph.D.
Stephen F. Austin State University	S	School of Forestry	1947	Forest management Forest fire management	Forest engineering [7] Wood technology [7]	B.S. in forestry	M.F. M.S. in forestry D.F. [8] Ph.D. [8]
Auburn University	SL-G	School of Forestry	1948	Forest management	Forest engineering Forest products	B.S. in forest management B.S. in forest engineering B.S. in forest products	M.F. M.S. Ph.D.
Louisiana Tech University	S	School of Forestry	1948	Forestry Forestry–management Forestry–business	Wood utilization	B.S. in forestry B.S. in wood utilization	
Oklahoma State University	SL-G	Department of Forestry	1950	Forestry Forest management Forest science	Forest products [9]	B.S.	M.S.

Table 1—Professional forestry and forest-products educational programs in the South as of 1985 (in order of year of first graduation)—*Continued*

Parent institution	Type [1]	Forestry and forest-products academic units [2]	Year first professional degree awarded	Forestry majors and options offered [3]	Forest-products majors and options offered	First professional degrees offered [4]	Graduate degrees offered [5,6]
Mississippi State University	SL-G	School of Forest Resources Department of Forestry Department of Wood Science and Technology	1955	Forestry Forest management	Wood science and technology Forest products industries Wood engineering Wood science	B.S. in forest resources	M.F. M.S. Ph.D.
University of Arkansas at Monticello	SL-G	Department of Forest Resources	1957	Forestry Forest business Forest management Forest science		B.S. in forestry	

Clemson University	SL-G	College of Forest and Recreation Resources Department of Forestry	1959	Forestry Industrial forestry Forest economics and marketing Forest biology Forest protection Forest biometrics Forestry in the social context	Wood utilization Wood industries management Wood science Forest harvesting [9]	B.S. in forestry B.S. in wood utilization	M.F. M.S. Ph.D.
Virginia Polytechnic Institute and State University	SL-G	School of Forestry and Wildlife Resources Department of Forestry Department of Forest Products	1962	Forestry and Wildlife Forest resource management Computer applications in natural resource management	Industrial forestry operations Forest products utilization Forest products marketing	B.S. in forestry and wildlife	M.F. M.S. Ph.D.
University of Tennessee	SL-G	Department of Forestry, Wildlife and Fisheries	1966	Forestry Forest resource management	Wood utilization [9]	B.S. in forestry	M.S. in forestry [10] M.S.
Texas A. & M. University	SL-G	Department of Forest Science	1974	Forestry Forest management	Forest operations [9]	B.S.	M. Agric. M.S. Ph.D.

graduation)—*Continued*

Parent institution	Type [1]	Forestry and forest-products academic units [2]	Year first professional degree awarded	Forestry majors and options offered [3]	Forest-products majors and options offered	First professional degrees offered [4]	Graduate degrees offered [5,6]

First professional degree programs in forestry and, in some cases, related majors or options, meet accreditation standards of the Society of American Foresters for the 15 institutions listed above.

The program listed below is a candidate program for possible accreditation.

McNeese State University	S	Department of Agriculture	1956	Forestry		B.S. in forestry

[1] S = State, SL-G = State land-grant, P = Private.

[2] Includes only units involved in forestry and forest-products programs. Excludes, for example, Department of Wildlife, Department of Recreation Resources Administration, etc.

[3] Includes only majors and indented "options" or "concentrations" which (in the author's opinion) primarily relate to (1) management of forest land for timber products; (2) harvesting, processing, marketing, and utilization of timber and wood-based products; or (3) graduate study in these areas. Excludes, for example, Forest water resources, Fish and wildlife biology, Forest recreation, etc.

[4] B.S. = Bachelor of Science, M.F. = Master of Forestry.

[5] M.F. = Master of Forestry, M.F.R. = Master of Forest Resources, M.S. = Master of Science, Ph.D. = Doctor of Philosophy, M.W.P.S. = Master of Wood and Paper Science, M.A. = Master of Arts, M.F.R.C. = Master of Forest Resources and Conservation, D.F. = Doctor of Forestry, M.Agric. = Master of Agriculture.

[6] Generally masters degrees which do not include the term "science" are nonthesis degrees.

[7] Option under Forest Management major.

[8] Doctor of Forestry is granted by Stephen F. Austin State University. Doctor of Philosophy is granted by Texas A. & M. University under cooperative agreement.

[9] Option under forestry major.

[10] There is a nonthesis option under this degree.

Prior to the 1960's, technician-training programs had been started and then discontinued by certain senior universities or colleges. Professional-level programs evolved from such a beginning in some cases (Dana and Johnson 1963, Chamberlin n.d. unpubl.). But in 1985, technician training was conducted by community colleges, junior colleges, or technical colleges in the South for the most part.

The major function in these institutions is resident instruction. Faculties are usually small with heavy teaching loads that leave little time for other activities (Moser, personal communication). Only five of these institutions indicated they were involved in continuing education on limited to moderate scales. By 1985, the Society of American Foresters had recognized 8 of the 14 as meeting or exceeding minimum standards for forest technology programs (Elliott 1985).

The 14 institutions and certain program characteristics of each are listed in table 2 in order of year of first graduation.

Other Characteristics of Professional-Level Programs and Program Units

The senior universities exhibited considerable diversity in organization, fields offered, and cooperative relationships.

Organization—At the 12 land-grant institutions in particular, many current forestry and forest-products programs originated in agricultural departments, colleges, experiment stations, and extension services. In a number of cases, the teaching of forestry and farm-forestry courses for agricultural majors or the conduct of forestry research by one or two agricultural or forestry faculty under the State agricultural experiment station and/or extension forestry projects under the State Agricultural Extension Service (today the Cooperative Extension Service) led to the establishment of a forestry–forest products academic department (Chapmen 1935, DeVall 1978, Clapp 1980 unpubl., Saylor 1979, Trulove 1984, Maughan 1939, Dunn and Holladay 1977).

Initially, then, such programs were tied to and subordinate to agriculture. As they have grown and matured, the tie has remained, by and large. Organizationally, however, they have moved toward a parallel and equal rather than subordinate relationship to agriculture, especially in the resident instruction function.

Unit titles are indicative. In 1985, one land-grant forestry–forest products unit was a "college"; seven were "schools," some of which had status equivalent to a college; only four retained the "department" designation. Two of

graduation)

Public parent institution	Location	Year first technology degree awarded	Curricula offered [1]	Degrees offered	Society of American Foresters recognition status
Lake City Community College	Florida	1948	Forest technology Forest-engineering technology	Associate of Science in forest technology Associate of Science in forest-engineering technology	Recognized
Patrick Henry State Junior College	Alabama	1967	Forest technology	Associate in Applied Science	Not recognized
Wayne Community College	North Carolina	1967	Forest-resources technology	Associate of Applied Science	Recognized
Haywood Technical College	North Carolina	1968	Forest-management technology Wood-products technology	Associate in Applied Science	Recognized
Savannah Tech	Georgia	1968	Forest technology–Forest technician	Two-year diploma	Recognized
Eastern Oklahoma State College	Oklahoma	1970	Forest technology–Timber management	Associate of Applied Science	Recognized
Abraham Baldwin Agricultural College	Georgia	1971	Forest technology	Associate in Forest Technology	Recognized
Horry-Georgetown Technical College	South Carolina	1971	Forest-management technology	Associate of Science in agricultural technology	Recognized
Dabney S. Lancaster Community College	Virginia	1976	Forest technician	Associate in Applied Science	Recognized
Southeastern Community College	North Carolina	1976	Forest technology	Associate in Applied Science	Not recognized
Chattanooga State Technical Community College	Tennessee	1978	Forestry, fisheries and wildlife management	Associate of Science	Not recognized
Lurleen B. Wallace State Junior College	Alabama	1982	Forestry technology	Associate of Science in forest technology	Not recognized
McNeese State University	Louisiana	1984	Forest technology	Associate of Science in forest technology	Not recognized
Orangeburg–Calhoun Technical College	South Carolina	1984	Forest-products technology	Associate in Science in agricultural technology	Not recognized

[1] Includes only 2-year curricula which primarily relate to the operation of forest land for timber production, or to timber and wood-products harvesting, processing, marketing, and utilization operations. Excludes curricula such as Arboriculture and Urban Forestry, for example.

the three non-land-grant public university forestry program units were "schools." At the one private institution, Duke University, forestry has enjoyed school status since the subject was first offered in 1938 (Warren and Wiseman 1985; Jayne, personal communication).

Forestry and forest-products research at the land-grant universities was generally administered through the State agricultural experiment stations. The one exception was Clemson University. Here the Department of Forestry was located in the College of Forest and Recreation Resources. Resident instruction and research were totally independent of the College of Agricultural and Biological Sciences and the agricultural experiment station (Box, personal communication).

In all 12 land-grant universities, extension forestry and forest-products programs were administered with and through the State Cooperative Extension Services. But the relationship of these programs and extension staffs to the forestry and forest-products academic unit varied considerably. At the University of Georgia, extension forestry was part of the College of Agriculture. The extension staff were housed separately from School of Forest Resources faculty. There were no joint appointments (Gunter, and Brightwell and Baxter, personal communications). By contrast, at Virginia Polytechnic Institute and State University (VPI and SU), the 10 faculty members with extension appointments were housed with their research and teaching counterparts and had academic rank in the School of Forestry and Wildlife Resources. All but two had part-time research appointments and responsibilities in addition to extension (McElwhee, personal communication). A similar relationship is followed at the University of Florida (Lee, personal communication).

At the nine remaining land-grant institutions, the degree of integration varied between these two extremes.

Fields Offered—This history focuses on programs in forestry, primarily for timber production, and in forest-products fields. But 12 of the 16 universities conducting such programs also conducted programs in related renewable natural-resources fields such as wildlife management, fisheries science, recreation resources and park management, and environmental science and conservation (Warren and Wiseman 1985). The existence of these fields is important because they provide opportunities for cross-fertilization, which has often resulted in substantial contributions to the timber and forest-products sector.

Wildlife management is a case in point. At Stephen F. Austin State University, the School of Forestry has been involved cooperatively with hunting clubs of major landowning companies in East Texas in research on deer–habitat relationships and habitat management. This research has contributed to keeping some 5 million acres (2 million ha) of hunting lands in timber production under management systems that enhance both wildlife and timber productivity (Adair, personal communication). Similarly, at Mississippi State University, the effect of 15 years of research and extension on the relationships between commercial forestry and whitetail deer and wild turkey by the School of Forest Resources has been to bring or keep a vast amount of forest land in the timber supply base that otherwise would have been managed on a custodial basis (Foil and Monaghan, personal communications).

Cooperative Relationships—In the introduction to his book "Professional Forestry in the United States," Henry Clepper (1971) wrote that

> . . . [F]orestry has been a cooperative development. From its inception, it has been characterized by cooperation between government agencies on the one hand and private landowners and the forest industries on the other. This cooperative design has been further extended to encompass close working relations between these groups and the forestry schools and experiment stations.

Clepper's "cooperative design" also clearly applies to the development and operation of southern university and technician-school forestry and forest-products programs.

Forestry and forest products are usually considered applied sciences and are highly multidisciplinary. Within the educational institutions, the strength of such programs has depended in no small part on the strength of supporting disciplines and effective linkages to them. In both resident instruction and research, examples include department and/or graduate faculty groups in botany, biology, entomology, zoology, plant pathology, soil science, agronomy, genetics, computer science, statistics, agricultural and resource economics, and agricultural, civil, and mechancial engineering. There are often joint, adjunct, or courtesy appointments between forestry and such departments. Faculty in entomology and plant pathology often teach courses in forest entomology and forest pathology—primarily for forestry and forest-products students. There is much cross-fertilization in the makeup of graduate-student

supervisory committees and in graduate-student programs. Forestry and forest-products faculty have been authorized by departments of agronomy or genetics or engineering to direct Ph.D. programs under their banners where the student's thesis research is in the forestry or forest-products area and the forestry unit is not authorized to offer its own Ph.D. (and sometimes when it is). There has been much collaboration in research with faculty in other units playing key roles in such forestry-supported research areas as forest fertilization, pest management, forest engineering, and tissue culture and genetic engineering, to cite just a few.

Beyond the immediate institution, most university forestry and forest-products programs have an extensive and complex network of relationships with employers and potential employers of their graduates; research and extension clientele; Federal, State, and local agencies; trade associations; citizens' groups; professional societies; and one another. Most schools and departments have one or more advisory committees made up of representatives from part or all of this network, which meet regularly to review progress, assess needs, recommend priorities, and generate moral, political, and financial support. In addition, special one-time committees are often established, to advise on curricula revision, for example.

At 9 of the 16 senior institutions there are one or more formal, continuing research, development, and application cooperatives in forestry and forest-products specialized areas. These are joint endeavors jointly funded by the university program unit and outside groups such as forest-industry companies, harvesting and harvesting-equipment firms, State forestry organizations, and, in some cases, the USDA Forest Service. The first cooperatives to be established were in the field of tree improvement, but the model has since been applied to various other areas.

One prominent university forestry leader, J. Charles Lee, believes that cooperative planning with users is more advanced in southern university forestry research than in any other commodity or resource in any region of the United States.

There has been a close working relationship between the research branch of the USDA Forest Service and university programs. The Forest Service has its own research laboratories on the campuses of Auburn University, the University of Georgia, and Stephen F. Austin State University, and near Mississippi State University. At the University of Arkansas at Monticello and at Clemson, Duke, Florida, and

North Carolina State Universities. Forest Service research scientists have been housed with university forestry and forest-products faculties. Under both circumstances, Forest Service scientists hold adjunct and graduate faculty appointments, supervise graduate-student programs, present seminars, share laboratory and other facilities, and collaborate in research.

The schools have also related to one another in research and other functions through the National Association of Professional Forestry Schools and Colleges. One function of this organization is joint regional and national planning of research with the Forest Service (National Association of Professional Forestry Schools and Colleges 1985). The schools also collaborate on regionwide projects organized through the Southern State agricultural experiment station directors.

From the beginning, extension has been a three-way cooperative venture between the USDA Extension Service, the land-grant universities, and county governments (county agent system). Under terms of the Renewable Resources Extension Act of 1978, State advisory committees for extension forestry and forest-products programs are mandatory.

At the individual State, multicounty, and county levels, extension forestry and forest-products programs operate with and through formal and informal networks, including university research scientists and programs, USDA Forest Service research, other USDA agencies, the Tennessee Valley Authority, State forest services, State forestry associations, trade associations, professional societies, landowner associations, 4-H clubs and sponsors, forest-industry companies, timber-harvesting firms, forestry-equipment firms, consulting foresters, conservation contractors, and a host of other interests and organizations. A major step forward was the creation in 1978 of a position for a regional extension forester for the South to coordinate planning, special Southwide initiatives, and the preparation of educational materials. This effort was cooperatively planned and funded by the extension directors of the Southern States and the USDA Forest Service's Southeastern Area, State and Private Forestry (Wade and Neal, personal communications).

Program Impacts

The cooperative nature of university and technician-school programs should be kept in mind as we look at examples of the impacts of such programs on the development of the southern forest resource and the southern forest-products industry. In many

instances these impacts have resulted from collaboration and shared inputs of other organizations and individuals.

Cases cited will be those where the university or technician school had leadership or at least coleadership responsibility.

In contrast to action programs, university and technican-school programs usually produce the **means** to the end results rather than the end results themselves. University and technician-school faculties do not fight fires, operate forest-tree nurseries, run harvesting firms, or manufacture lumber, plywood, or pulp and paper. Rather, they train those who do. They also develop, through research, new and better methods and materials. Through extension and continuing education, they interpret and transfer such knowledge in applicable form to the action and regulatory organizations and individuals.

Two conclusions seem reasonable:

(1) The universities and technician schools often lose track of the final effects of their intermediate contributions. They do not know to what degree a new finding is applied, nor the resulting change in productivity, profitability, or policy from its real-world application. Thus, concrete measures of impact are scarce.

(2) Other inputs of capital, management, adaptation on the ground, and preexisting knowledge are involved in the application of new skills or new and improved technology. Thus, it is difficult to sort out the value of the university research and extension input and pinpoint it to a particular region, institution, or program (Hyde and Newman, personal communication).

I sought and did not find any across-the-board impact evaluations of university or technician-school resident instruction, research, or extension programs in forestry or forest products for the South. For the most part, I have had to use case examples from individual programs at institutions as indicators of the type and magnitude of the impacts of such programs. When these are cited, the reader should remember that the university input to the end result may often have been cooperatively developed, and was only one of several (though often the most important) in producing the improvement cited.

During the Lumbering Period (1880 to 1930)

The Early Programs—In 1898, the first two forestry schools in America opened for business. One of these was in the South—the Biltmore Forest School located on George Vanderbilt's Biltmore Estate near Asheville, NC.

Biltmore offered a 1-year "highly practical but professional" training program leading to a "Bachelor of Forestry" degree to male high-school graduates 20 years of age and older with some lumbering experience. With 2 additional years of practical forest work, the graduate qualified for a second degree, "Forest Engineer" (Dana and Johnson 1963, Jolley 1971).

Biltmore opened in 1898 and closed because of low enrollment in 1913. During this period, approximately 300 graduated, and more than half of them went into forestry after graduation. Most went to work for public forestry agencies, although the purpose of the program in the eyes of the founder and director, Carl Schenck, was to prepare men for forestry careers in industry (Tainter and Cool n.d., post 1974; Clepper 1971).

In 1906 the University of Georgia established the second southern forestry program. The professional forestry teaching program started in 1909 and produced its first graduate in 1912. From then through 1924, the program operated at a low level, producing only eight graduates.

Although a "concentration in logging engineering" was offered beginning in 1913 to 1915, a 1935 report to the Society of American Foresters listed only a single undergraduate 4-year curriculum in forestry leading to a bachelor of science in forestry degree.

Through 1934, Georgia's program had graduated a total of 71, with 67 reported as entering the forestry field. The first master's degree was awarded in 1932 (Chapman 1935).

Louisiana State University established a curriculum leading to the bachelor of science in forestry degree in 1924. The first such degree was awarded in 1926 to a 2-year transfer student. A Department of Forestry in the College of Agriculture was established in that same year. Through 1934, the Department graduated 41 in the single curriculum offered—"technical forestry." Of these 41, 35 entered forestry after graduation (Blackwell and Burns 1963, Chapman 1935).

The Department of Forestry in the School of Agriculture of North Carolina State College of Agriculture and Engineering (now North Carolina State University) was founded in 1929. It hit the ground running because of an

influx of advanced students who transferred in from the Pennsylvania State Forest Academy at Mont Alto, which was abolished in that year. Consequently, North Carolina State awarded its first forestry degrees in 1930.

As of 1935, the department was offering four courses of study: forest management, forest utilization, silviculture, and research in forestry problems. All led to the bachelor of science degree. It also offered graduate training for a master of science in forestry degree. Through 1934, it turned out 58 graduates, 49 of whom were "engaged in forestry or kindred pursuits" (Chapman 1935, Saylor 1979).

Thus around the close of its bonanza lumbering period, the South had seen four programs established to educate professional foresters. One had closed. Three were offering bachelor's level programs in forestry. One of these (after 1930) had initiated a curriculum in forest utilization. Two of the three had started graduate programs at the master's level.

As of 1930, there were no wood science and technology programs in the South (Ellis 1964).

No technician-training programs in the South were in operation at the close of the bonanza lumbering period. One had operated at the University of Georgia and a second at Louisiana State Univesity for a few years, but both were discontinued in the mid-1920's (Dana and Johnson 1963).

Cumulative Total Graduates and Placement—Through 1934, the four programs had produced 470 graduates (300 from Biltmore). An estimated 300 had entered forestry-related careers.

Placement information is sketchy. Most of these bonanza-era graduates undoubtedly went to work for public forestry agencies. National records show that out of the 2,000 foresters graduated nationally from 1900 to 1920, only 20 were privately employed. In 1934, only 220 out of the Society of American Foresters national membership of 2,076 were privately employed. In the South in 1928, the pulp and paper industry employed fewer than 12 full-time foresters (Clepper 1971).

Contribution to the South's Professional Work Force—The number of southern forestry program graduates of this era who went to work in the South could not be determined. Thus, the contribution of the southern schools to the South's early professional forestry work force can only be estimated. This contribution was undoubtedly modest because, with the exception of Biltmore, southern

professional forestry education lagged behind that in the North and Midwest (Dana and Johnson 1963). It follows that a high proportion of the South's early foresters were educated elsewhere.

I attempted to estimate the South's contribution to forestry education as of 1929. In that year the Society of American Foresters published a directory of its membership. A total of 148 junior and senior members were located in the 12 Southern States (Society of American Foresters 1929). In 1985, 34 of these people were still carried on the membership rolls. Thirty-one of the 34 had received a professional forestry degree. Only one of these had graduated from a southern school.

By this very shaky evidence, I estimate that 1 out of 31, or 3.2 percent, of the professionally educated foresters in the South near the end of the bonanza period had been educated in the South.

During the South's Second and Third Forest Periods (1930 to 1985)

Development of University Programs—After 1930, six factors created surges in demand for professional forestry and forest-products graduates and for scientists in these fields that led to rapid expansion in southern resident instruction programs.

In 1933, the establishment of the Civilian Conservation Corps, the Soil Erosion Service (later the Soil Conservation Service), and the Tennessee Valley Authority created a demand for foresters during the worst of the Great Depression, when the employment outlook for other professions was bleak. Nationwide, enrollment in forestry schools jumped by 69 percent from 1933 to 1934 and an additional 43 percent in the following year. Existing forestry schools were flooded (Dana and Johnson 1963).

The South also benefited in the 1930's from the growth of the pulp and paper industry. The industry's development of wood-procurement systems and forestry programs on its own lands, and its initation of conservation programs with outside landowners contributed to a growing demand for trained professionals and, later, technicians as well (Clepper 1971).

During the 1930's, three new professional degree programs were established in the South—at VPI and SU in 1936 (in the biology department—forestry became a separate unit and program in 1959), at the University of Florida in 1937, and at Duke University (the graduate level only) in 1938 (Dana and Johnson 1963).

World War II greatly reduced enrollments, and no new resident instruction programs were established until 1945 (Dana and Johnson 1963). But the war did reveal a need for trained wood

technologists and scientists—a need that increased during the postwar boom in home construction, furniture, packaging, pulp and paper, and other wood-based products (Ellis 1964).

This postwar boom was accompanied by the return of war veterans and the passage of the GI bill, which provided them with tuition and support funds to prepare themselves for civilian careers. Forestry schools were overwhelmed. Nationally, undergraduate enrollment jumped 1,128 percent from 1944 to 1946 (from 571 to 7,010). Graduate enrollment increased 1,317 percent over this same period. Nationally, seven new 4-year undergraduate programs were established between 1945 and 1949. Four of these were in the South: Auburn, Louisiana Tech, and Oklahoma State Universities in 1946; Stephen F. Austin State University in 1947 (Dana and Johnson 1963).

Arkansas A. & M. (now the University of Arkansas at Monticello) and Mississippi State soon expanded existing courses of study into full-blown professional forestry majors in 1950 and 1954, respectively. McNeese State started a forestry program in 1954. Clemson began a professional program in 1957. Tennessee and Texas A. & M. followed later.

Duke, Auburn, and North Carolina State were the first to initiate professional programs to meet the need for trained people in wood science and technology. Duke began a master's level program before World War II; Auburn established an undergraduate curriculum in 1946; North Carolina State began in 1948. These were followed by Florida about 1956 and Louisiana State University, which began offering a master's level program in 1961.

By the end of 1960, 107 bachelor's and 153 master's degrees in wood science and technology fields had been awarded in the South. Duke University (1953) and North Carolina State (1958) began offering Ph.D. programs to train scientists for research and teaching careers (Ellis 1964). In addition, in 1952 North Carolina State established the first (and only) undergraduate program in pulp and paper technology in the South, to train people for careers in pulp and paper manufacturing (Saylor 1979).

Rapid postwar growth of forest industries and their forestry programs resulted in a long-term growth in demand for professional foresters in the South. By 1960, the 73 pulp and paper mills in the 12 Southern States employed a total of 1,396 (Southern Pulpwood Conservation Association n.d.); by 1976, there were 112 mills employing 2,208 (Southern Forest Institute n.d.).

A fifth factor affecting the demand for trained foresters was the growth of Southern State forestry

programs and organizations after World War II. I found no figure on their prewar employment of professional foresters, but in 1960 they employed a total of 492 professional foresters (Myers 1960). By 1985, the total had increased to 999 (Warren and Wiseman 1985).

A final factor was the growth of research programs in the schools occasioned by the rapid increase in reforestation and the initiation of large-scale intensive timber-management programs on forest-industry lands and of multiple-use management systems on public forest lands. Cooperatively funded research programs by industry, State forestry organizations, and the schools were begun in the 1950's initially in the field of forest genetics and tree improvement. These programs plus the passage of the McIntire–Stennis Cooperative Forestry Research Act in 1962, which provided Federal funding on a matching basis to the schools for research and graduate training of scientists, led to substantial expansion of graduate programs at the master's and doctoral levels. Duke granted its first Ph.D. in forestry in 1938; North Carolina State did so in 1953. Eight of the remaining nine doctoral-level programs in forestry produced graduates from 1964 on. The ninth, at Clemson University, was initiated in 1985.

As of 1985, there were four doctoral programs in wood science and technology (Duke, Mississippi State, North Carolina State, VPI and SU), one in harvesting (VPI and SU), and one in pulp and paper science (North Carolina State under a "Wood and Paper Science" designation).

Unique Professional Degree Programs—A number of past and current programs have been unique in orientation or structure. The following are but a few examples.

Duke University School of Forestry and Environmental Studies—Duke has been unique for several reasons. It was the only private university in the South with professional forestry and forest-products programs in 1985. It has operated such programs at the graduate level only: the master of forestry degree has been its first professional degree since the teaching program began in 1938. This was a nonthesis master's degree until recently. One year of study was required for persons with a bachelor's degree in forestry and 2 years for those with a bachelor's degree in a science basic to forestry.

Early in its master of forestry program, Duke worked out a unique 3–2 arrangement with liberal arts colleges and universities not offering forestry. Under this Cooperative College Program, students who followed a coordinated 3-year undergraduate program in one of the natural or social sciences, pre-engineering,

business, natural resources, or environmental science entered Duke's School of Forestry and Environmental Studies at the beginning of the fourth year. Upon satisfactory completion of this fourth year, the student received the bachelor's degree from the undergraduate institution; at the end of the fifth year, the master of forestry degree from Duke. (A similar arrangement is currently offered leading to a master of environmental management degree.) (Smith 1984).

As early as 1959, this 3–2 relationship had been established with 62 colleges and universities (Korstian 1969). By 1985, 90 institutions were partners with Duke in this arrangement (Jayne, personal communication).

This program has produced students with an unusual diversity of backgrounds.

Forest Business Programs—In 1960, Duke was one of the first schools to develop a structured degree program in the business aspects of forestry. This program leads to the degree of master of business administration in forestry. This was a joint program of the then School of Forestry and the Department of Economics and Business Administration. It featured three semesters of coursework at Duke followed by a 6-month internship with one of 14 or 15 cooperating forest-industry companies, which paid full salaries to the students while in intern status.

Some 25 to 30 students completed this program during the 1960's. All were offered positions by the companies in which they were interns. Most started in company regional offices as woodlands economic analysts. A number became woodlands division managers; some went on into corporate internal auditing departments; four to five rose to be corporate vice presidents, or corporate vice presidents for woodlands (Yoho, personal communication).

The program was discontinued when its founder, James Yoho, left to take a position with the forest industry. But other schools have since gotten into the field of forest business education. In 1977, the University of Tennessee began offering a master of business administration with a concentration in forest industries management to people with bachelor's degrees in forestry. In 1983, the University of Georgia began offering a master of forest resources–forest business management degree. Arkansas, Clemson, Louisiana State, and others have offered options in forest business within the undergraduate forestry major. At Mississippi State, North Carolina State, and elsewhere, undergraduate programs have been developed in which the forestry graduate can earn a second bachelor's degree in business or

economics in an additional year or half year.

Forest Engineering Programs—Auburn and VPI and SU have pioneered in timber-harvesting programs.

VPI and SU opened its industrial forestry operations program in 1974 to prepare foresters more adequately for entry-level positions with forest industry in wood procurement and mechanized timber harvesting. The program involved a battery of courses in agricultural engineering, engineering science and mechanics, business, forestry, and forest products around the forestry core. The program meets accreditation standards of the Society of American Foresters. Placement of its more than 250 graduates to date has been well above the national average for forestry. Master's and Ph.D. programs have been added as well (Shaffer 1984).

More recently, Auburn University began offering an undergraduate major leading to a bachelor of science in forest engineering degree. It was established as a joint major of the School of Forestry and the Department of Agricultural Engineering. It meets accrediting standards of the Society of American Foresters. It is designed to meet those of the Accrediting Board for Engineering and Technology as well, but will not be reviewed by this body until 1986. The only other such program in the Nation is at the University of Maine. By the end of 1984, approximately 20 people had received this degree (E. Thompson and Tufts, personal communications).

Pulp and Paper Technology—The only undergraduate and graduate degree programs in pulp and paper science and technology are at North Carolina State University's School of Forest Resources. An undergraduate program leading to a bachelor of science in pulp and paper technology was initiated in 1952 with strong support from southern pulp and paper industry leaders. In 1955, these interests set up a special pulp and paper foundation to provide scholarships Southwide, supplement faculty salaries, and provide teaching and research laboratory equipment. The program enjoyed regional recognition from the beginning through an agreement with the Southern Regional Education Board. In its 30-year history, the program produced 579 graduates, some 85 percent of whom are estimated to have entered the southern pulp and paper industry upon graduation. Graduate programs at the master's and Ph.D. levels were initiated in the late 1950's (Saylor 1979; Thomas and Hitchings, personal communications).

Cumulative Contributions of Southern University Programs to the South's Professional Work Force in Forestry and Forest Products—In the first 36 years since the Biltmore Forest School started (1898–1934), Biltmore, Georgia, Louisiana State, and North Carolina State produced a combined total of 470 forestry graduates. An estimated 300 entered the field upon graduation. There is no estimate as to how many of these went to work in the South.

The number graduating in the past 50 years from southern institutions and the proportion of these entering their chosen fields in the South are far less clearly documented. Based on interviews, the judgment of program leaders and faculty, and school records, my very rough estimates are as follows:

- Total number of first professional degrees granted in forestry and forest-products fields by southern universities and colleges since 1934—18,700.
- Total number of graduates who entered a related position in the South—11,140 (59.6 percent).

For the forest-products fields, I had hoped to develop indications as to the proportion of the South's professional work force from southern university programs by sampling the southern membership rolls of the Society of Wood Science and Technology and the Forest Products Research Society. But the available data bases did not include such information (Thomas, personal communication).

For professional foresters, I sampled the southern membership rolls of the Society of American Foresters in 3 separate target years (1929, 1962, and 1985) to determine what proportion of the membership had received the first professional degree from a southern institution. The first 2 target years were chosen because the Society published membership directories in those years, and they came close to coinciding with the end of the bonanza era (1929) and the midpoint of the Second and Third Forest Eras (1962).

Table 3 suggests that the proportion of professional foresters in the South with the initial professional degree from a southern school grew from 3.2 percent in 1929 to 61 percent in 1962 to 68 percent by 1985. Thus, by the 1960's southern schools had trained the majority of the professionals who were managing the world's largest example of intensive, high-production forestry (Lee, personal communication).

Further indicators of the proportion of the current southern professional work force educated in the South are samples taken of the 1984 southern membership of the Association of Consulting

Table 3—Proportion of southern members of the Society of American Foresters who received the first professional forestry degree from a southern school

Proportion of southern members	Year		
	1929	1962	1985
Total number of southern members	148	3,502	4,803
Type of sample taken	100%	2.5%	2%
Total names in sample	148	109	83
Total records found	34	69	73
Total records showing a professional forestry degree	31	56	44
Total records showing the first professional forestry degree from a southern school	1	34	30
Percentage of professional forestry degree holders with the first such degree from a southern school	3.2	60.7	68.2

Foresters and of State rosters of registered foresters in Alabama, Mississippi, and North and South Carolina. Results are listed in table 4. These show consistently higher proportions of practitioners with southern educational backgrounds than the 1985 Society of American Foresters sample.

In terms of persons trained at the doctoral level for potential careers in research and teaching, the southern institutions with professional forestry programs have graduated an estimated 577 since Duke first began in 1938. Most of these degrees have been in forestry rather than forest-products specialties.

No effort was made to estimate what proportion of these graduates entered careers in the South.

No estimate was made of the number of persons trained at the master's level because of the

Table 4—Proportion of members of certain professional organizations receiving the first professional forestry degree from a southern institution

Organization	Type of sample	Total in sample	Total with professional forestry degree	Total with professional forestry degree from a southern school	Percentage of professional forestry degree holders with southern degrees
Association of Consulting Foresters [1]	Southern members—100%	171	171	133	77.8
Alabama Board of Registration for Foresters [2]	Random starting point: 5% systematic sample of 960 members	47	46	41	89.1
Mississippi Board of Registration for Foresters [3]	Random starting point: 5% systematic sample of 1,000 members	52	40	36	90
North Carolina Board of Registration for Foresters [4]	Random starting point: 5% systematic sample of 479 members	24	19	15	79
South Carolina Board of Registration for Foresters [5]	Random starting point: 5% systematic sample of 650 members	[6] 49	44	37	84.1

[1] Data base was "1984 Membership Specialization Directory," Association of Consulting Foresters, Bethesda, MD.

[2] Sample taken on May 27, 1985, at Montgomery, AL, headquarters.

[3] Sample taken on May 23, 1985, at Jackson, MS, headquarters.

[4] Sample taken on May 1, 1985, at Raleigh, NC, headquarters.

[5] Sample taken on May 30, 1985, at Columbia, SC, headquarters.

[6] Obviously 49 is not 5% of 650. The sample included records of some 250 + additional delinquent registrants, most of whom were expected to renew

likelihood of counting the same people twice.

Production of Top Leaders—Undoubtedly every institution that has been producing graduates for 20 years or more has alumni who have risen to key leadership positions in the South. Though I did not raise this point with all program leaders interviewed, those with whom it was discussed could identify graduates who had become State foresters, pulp and paper company woodlands managers or vice presidents, prominent consultants, association executives, and the like.

Perhaps the only published listing of distinguished alumni is that of the Duke School of Forestry and Environmental Studies. It is cited here to illustrate further the types of key leaders produced by southern programs of fairly long standing.

From the 1930's through 1983, Duke awarded 562 master's and 165 doctor's degrees in forestry and areas related to forest products (Matthews, personal communication). In 1980, the School of Forestry and Environmental Studies published biographies of 63 graduates that a faculty committee believed to represent a cross-section of those who had attained positions of leadership. By sector and location, they were distributed as follows (Duke University School of Forestry and Environmental Studies 1980):

Education
24 university faculty who had attained prominence as scientists, teachers, and/or administrators. Twelve were with southern institutions or had spent a considerable part of their careers in the South.

Government
15 prominent USDA Forest Service research scientists and/or administrators. Thirteen were in the South or had extensive career time there. Two had been deputy chiefs for research—the top research leadership position in the agency.

Private
20 graduates prominent in the private sector. All were in the South or were leaders in companies with extensive southern operations. Five were regional or national vice presidents of major forest-products companies. Two were presidents of important subsidiaries. Three were presidents and/or owners or partners in well-established forestry consulting firms.

Training Programs for Forestry and Forest-Products Technicians—Some of the same factors that caused surges in demand following World War II for professionals in forestry and forest products also created demands for trained

subprofessionals or technicians. They were needed in a variety of capacities, such as:

Federal forest survey crews and crew leaders.
County and multicounty rangers with State forestry organizations.
Timber cruisers and timber markers for wood buyers and consulting-forestry firms.
Wood buyers for wood-procurement firms.
Surveying and boundary-line marking crews.
Managers of field operations for gum and wood naval-stores.
Site-preparation and planting crews and crew leaders.
Logging-equipment operators and logging supervisors.
Log scalers, lumber graders, and sawmill foremen.

Prior to World War II, three universities in the South had started and discontinued programs to train forest technicians. The first to become permanent was started in 1947 as a private endeavor—the Columbia Forestry School at Lake City, FL. It offered an 11-month training program. In 1949 it was taken over by the University of Florida and operated as the State Forest Ranger School. In 1962, it separated from the University of Florida and became part of the newly established Lake City Junior College, for which it was the nucleus (Dana and Johnson 1963). It added a 2-year program in forest technology in 1967 and a 2-year program in forest engineering technology in 1970 (Knudsen, personal communication).

For 20 years after its founding, this was the only forest-technician training program in the South. But in 1962, Congress passed the Manpower Development Training Act, which made Federal funds available on a matching basis through State departments of education to junior or community colleges to help support vocational–technical training programs. A number of the 13 additional forest and forest-products technology programs in the South were established partly as a result of this development (Moser 1985 unpubl.).

Since Columbia Forestry School's first graduation in 1948, 3,747 forest technicians and forest-engineering technicans have been trained by the southern institutions with 2-year programs. An estimated 2,508 (67 percent) of these graduates went to work in a related job in the South.

Two of the 14 institutions have graduated 136 wood-products technicians. An estimated 112 (82 percent) of these graduates entered a related job in the South.

Determining the total population of 2-year forest and wood-products technicians in the southern work force for any selected target year

would not be impossible; it was simply beyond the scope of my assignment. Thus, the proportion of the population trained in southern institutions could not be estimated.

"Forestry is the science, the art and the practice of managing and using for human benefit the natural resources that occur on and in association with forest lands" (Ford-Robertson and Winter 1983).

This definition in a recent terminology publication of the Society of American Foresters is much truer today than it was in 1921, when the USDA Forest Service established the Southern Forest Experiment Station at New Orleans, LA, and the Appalachian (now Southeastern) Forest Experiment Station at Asheville, NC. Forestry was far more "art" than "science" in 1921. And such science as early southern foresters tried to apply was mostly borrowed from middle and western Europe.

Today's forestry, as practiced in the South and elsewhere is still part art. In spite of the wealth of knowledge and new technology developed through research and trial and error, much remains unknown. Keen judgment is required in interpreting what is known and adapting it to local situations. As Howard Hanna (1972 unpubl.) once put it, "The forester still needs to know the swamp from the inside out."

But since the early days of southern forestry, there have been great gains from research and its application in forest productivity, utilization, product development, harvesting and processing

methods, and efficiency. And although southern universities started later than their sister institutions to the north and west, today they are major and still growing partners with Federal agencies and industry in forestry and forest-products research.

During the Lumbering Period

Before 1928, most forestry schools in the Nation had only two- to four-member faculties. Teaching plus extension responsibilities added up to heavy workloads. There was little time for research. Agricultural research was going forward at the land-grant universities under stimulus of the Hatch Act of 1887, which provided continuing Federal funds on a matching basis through the State agricultural experiment stations. But not much forestry research had resulted. The main contribution during this early period was from certain northern universities that had established school forests (Kaufert and Cummings 1955).

Situations at the three southern universities with active teaching programs were a reflection of the national picture. In the 1934–35 school year, they had a combined total of just 11 1/2 full-time faculty. The Louisiana State University report at this time to the Society of American Foresters stated flatly, "No research projects have so far been attempted as full time is needed for teaching and camp instruction" (Chapman 1935).

But there were important exceptions. For example, before the Biltmore Forest School closed in 1913, Carl Schenck carried out the first large-scale plantings in the United States. These included a number of the most valuable hardwood species (which were complete failures for the most part) plus white pine and shortleaf pine, which were spectacularly successful even on severely eroded old fields. Schenck also carried out improvement and release cuttings and yellow-poplar regeneration cuttings. He kept cost and return records and set up permanent photographic stations for visual recordation (Schenck 1974). This on-the-ground evidence of what would and what wouldn't work was invaluable to the development of forestry in the southern Appalachians.

At Auburn Polytechnic Institute (now Auburn University), the Alabama Agricultural Experiment Station allocated $80 in 1926 to Professor H. M. Ware, head of the horticulture department, to produce pine seedlings for species trials. The following year he began making test demonstration plantings on 80 acres (32 ha) of the main campus, which were to become famous as the "Auburn Plantations." They included four different species planted to spacing ranging from 3 ft apart to 18 ft apart (1 to 2.8 m). Studies were

also started on the effects of fire with 1-acre (0.4-ha) plots demonstrating complete exclusion versus burning at 1-, 3-, and 5-year intervals. Thinning studies were initiated later as the plantings developed.

These plantings went out of business in the 1970's. But they had been viewed annually by more people in Alabama than any other examples of forest practices and stimulated great early interest in pine forestry. Several observers believe the plantings contributed more than any other university research in the Deep South to the development of general management guidelines (Ware 1947; DeVall 1978 and personal communication; Foil, personal communication).

During the South's Second and Third Forest Periods

1931 to 1962—Although the greatest growth in southern university forestry and forest-products research appears to have to occurred after passage of the McIntire–Stennis Act of 1962, some important building blocks were put into place in the 31-year period preceding it.

The first 20 years of this period were generally a slack time for forestry research in the universities. The 1930's saw, simultaneously, an enrollment boom due to the demand for forestry graduates to staff the CCC's and other Federal conservation programs coupled with cuts in State appropriations due to the Depression. During World War II, there was little expansion in forestry research anywhere except at the USDA Forest Service's Forest Products Laboratory. For 4 to 5 years after the war, schools experienced a second enrollment explosion due to the GI bill. Teaching again dominated (Kaufert and Cummings 1953).

Establishment of additional university research and demonstration forests constituted the major thrust of research-oriented activity during the period.

At Duke University, President Few brought Clarence Korstian aboard in 1931 to develop 4,600 acres (1,862 ha) of Piedmont forest and abandoned farmlands that had been given to Duke in the 1920's. Few instructed Korstian to develop a program "like the Harvard Forest" apparently in line with Duke's goal to become the "Harvard of the South." Korstian set it up as a self-sustaining enterprise for research, demonstration, and teaching. He conducted trials of many different techniques of regeneration, thinning, pruning, and prescribed burning. He established and maintained a system of permanent growth and yield sample plots, stand maps and study records that, in continuity and detail, are equal to any in the world (Edeburn and Jayne,

personal communications; Korstian 1969).

North Carolina State was next to develop a research forest. In 1934, J. V. Hofmann negotiated the purchase of the 83,000-acre (33,590-ha) White Oak Pocosin (later renamed the Hofmann Forest) for the North Carolina Forestry Foundation, which he had established in 1929. Thus began a large-scale demonstration and research program of forest development on a self-sustaining basis that became a model for private enterprise holding wetland muck and mineral soil properties in the South Atlantic Coastal Plain (Miller 1970; Ellwood, personal communication).

Farther south in this same year, George Aull, a land economist at Clemson College (now University), set up the Clemson Land Use Area, which has since become the Clemson Experimental Forest. The initial area of 29,665 acres (12,005 ha) was made up of cutover forest and worn-out cotton farms in the red clay South Carolina "up country" surrounding the college. By the end of the 1930's, some 15,000 acres (6,070 ha) had been tied down with trees. A major recreational lake had been developed, along with fish ponds, trails, and camp and other recreational sites.

Today 17,051 acres (6,900 ha) remain under management by the College of Forest and Recreation Resources. There are 39 research projects located on the forest. Since 1976, a large-scale management systems research project on a replicated design has been going forward. This study compares inputs and responses of forests managed for protection versus those managed for commercial timber production or multiple-use objectives.

The 50 years of empirical research provided much of the basis for management guidelines for forestry in the upper Piedmont and Blue Ridge foothills (Sorrels 1984; McGregor et al., personal communications).

Duerr and Vaux (1953) took note of these and other early empirical studies—particularly in the economic dimension. They credited forestry schools in the South and some parts of the East with making the greatest progress up to that time in farm forestry management and profitability demonstrations on permanent experimental-forest properties.

A major and unique research-related university role and contribution was the training of research scientists. Shortages turned up early. The Clapp Report of 1926–28 pointed up a need for more researchers in forestry. A 1938 survey of forestry research by the National Research Council identified 442 full-time researchers,

but only 16 percent had been trained at the doctoral level (Kaufert and Cummings 1955).

In the South, Duke's School of Forestry was the first to respond to this need. The School granted its first Ph.D. in 1938. North Carolina State followed in the 1950's. The remaining nine programs in the South came into being after passage of the McIntire–Stennis Act.

At Duke an early outstanding example of combining research with graduate training was the work of Ted Coile, Francis X. Schumacher, et al. They and their associates developed an informal master plan of studies to establish relationships between the growth and yield of southern pines and soil characteristics that could be measured in the field. From 1947 through 1957, these Duke scientists filled gaps in their own research data with thesis research of 27 master's and 6 doctoral students to model these relationships for the four major southern yellow pines plus pond pine. As a result, analyses for land appraisal, land and reforestation investments, and harvesting schedules became far more practical and precise (Jayne, personal communication).

Action began to pick up elsewhere in the 1950's as well. Over at College Station, Bruce Zobel initiated cooperative research in forest tree improvement between the Texas Forest Service and forest-industry companies. In 1954, one of Zobel's Ph.D. graduates, Ray Goddard, joined the faculty of the University of Florida's School of Forestry, where he established the Cooperative Forest Genetics Research Program with 10 companies initially as joint partners and participants. (Today there are 14 companies plus the Florida Division of Forestry.) (Goddard, personal communication).

The Florida Cooperative was the first to involve private companies as active joint participants. It focused on slash and longleaf pines. Two years after it was established, Zobel moved to North Carolina State to establish the largest such cooperative in the South—the North Carolina State–Industry Cooperative Tree Improvement Program, with emphasis on loblolly pine. Today there are cooperators from 25 forest-products companies and 4 State forestry organizations scattered over 13 States (Weir, personal communication).

Goddard and Zobel were pioneers in developing this research, development, and application cooperative model. It has proved to be a highly efficient mechanism in terms of research cost to the client, sharing of knowledge and materials, and almost instantaneous technology transfer from researcher to user. Such collaboration had already proven cost effective for research; it is now proving cost effective for the

development function as well. And it is beginning to be used to get needed long-range basic research underway (Weir, personal communication).

By 1985, there were a total of at least 20 such cooperatives (including the initial 2) at 9 of the 14 southern universities conducting forestry and forest-products research.

Elsewhere research was expanding under conventional arrangements. Important work was carried out at Mississippi State on fertilization and management for forest-tree nurseries (Foil, personal communication). Bottomland hardwood research got underway at Louisiana State (Louisiana State University, School of Forestry and Wildlife Management 1985 unpubl.). Black locust fertilization and cottonwood growth and yield studies went forward at Oklahoma State (Oklahoma State University, Department of Forestry 1983). Tree-improvement research was initiated in 1959 at the University of Tennessee in white pine, Virginia pine, loblolly pine, and yellow-poplar (Thor 1976). Extensive wood-preservation service tests were established at Florida, and forest fertilization work began there and elsewhere (Goddard, personal communication). These are but a few examples.

The McIntire-Stennis Act—Although momentum in university programs devoted to forestry research was building in the 1950's, land-grant university forestry leaders and key clientele registered considerable dissatisfaction with the low level of forestry research support received from Federal appropriations under the Hatch Act through the State agricultural experiment stations.

In 1952, the State stations received a total of $12.9 million in Federal funding, of which only $137,000 (about 1 percent) was allocated to forestry and related research (Kaufert and Cummings 1955). Eleven years later, the total had risen to $25 million, of which $800,000 (3.2 percent) was allocated to forestry (Gray 1977 unpubl.).

Although this was progress, leaders from forestry schools, industry, and the USDA Forest Service felt support was low in relation to the need to expand both research and the training of researchers in forestry and forest products. Accordingly, these interests pushed for and secured congressional passage of the McIntire–Stennis Cooperative Forestry Research Act in 1962.

This act had two objectives:

- To encourage and assist land-grant and other State-supported forestry schools to conduct research needed to improve the production, protection, and utilization of forests and associated rangelands

but primarily to improve timber production and utilization as evidenced by testimony surrounding passage); and

- To stimulate expansion in the training of scientists in forestry and forestry-related specialties needed by Forest Service, forest-industry, and university research programs.

Federal funds had to be matched one to one with non-Federal dollars (Gray 1977 unpubl.).

Post-1962 Development—Although the initial McIntire–Stennis appropriation was only $1 million and had grown to only $9.3 million by fiscal year 1983, the Act was a tremendous boost to the growth of university forestry and forest-products research nationwide. Indeed, one astute, long-time forestry and agricultural research administrator in the South, Rodney Foil, felt that modern southern university forestry research began with passage of the McIntire–Stennis Act.

To identify its impact, I conducted an informal survey through interviews with current leaders of six programs that were active in 1960. These programs were established at Arkansas, Auburn, Stephen F. Austin, Louisiana State, Mississippi State, and Tennessee. In 1960, the six had a combined total of 20 full-time-equivalent research scientists engaged in 41 different projects. By 1984, the totals had risen to 64 scientists and 181 projects. The number of scientists had more than tripled, and the number of projects had more than quadrupled.

More complete data, but for different years, are regional figures for fiscal years 1968 and 1983. Fiscal year 1968 was the first for which centralized reporting had been routinized under the national Computerized Research Information System (CRIS) of the Cooperative State Research Service.

Comparisons for these 2 years are shown in table 5. Sources are annual inventories of agricultural research published by the U.S. Department of Agriculture.

For the South, as well as for the rest of the Nation, McIntire–Stennis dollars were far more significant in providing leverage to generate other support than they were in themselves. For example, table 5 shows that in fiscal year 1968 southern university forestry research was supported almost equally by Federal and non-Federal organizations. But in fiscal year 1983, non-Federal funding was more than double Federal levels. State appropriations in fiscal year 1983 were more than 8 times 1968 levels, and those of industry grants were almost 14 times the 1968 levels.

Table 5—Growth in Commodity 0600 (timber and forest-products) research, southern region,[1] from fiscal years 1968 to 1983

Item	1968 [2]	1983 [3]	Ratios of FY 1983 totals to FY 1968 totals
Research scientist person-years[4]	91.5	166	1.8
Number of research projects	299	443	1.5
Total funding, all sources	$3,186,000	$21,785,000	6.8
Funding by individual sources:			
State appropriations	$1,295,000	$10,926,000	8.4
Industry grants	$185,000	$2,587,000	14.0
Other non-Federal	$197,000	$1,244,000	8.5
Non-Federal total	$1,677,000	$14,757,000	8.8
McIntire–Stennis	$929,000	$3,746,000	3.7
Hatch plus Regional Research	$278,000	$415,000	1.5
Other USDA grants	$248,000	$1,924,000	7.8
Non-USDA Federal grants	$54,000	$943,000	17.5
Federal total	$1,509,000	$7,028,000	4.7

[1] Includes State agricultural experiment stations, cooperating forestry schools, other cooperating institutions, for the 12 Southern States of this study plus Kentucky and Puerto Rico. Includes 1890 Land-Grant (primarily black) institutions, but their participation was minor. In FY 1983, three reported a combined total of only 2.4 scientist person-years and four projects.

[2] From "Inventory of Agricultural Research, Volume II, Fiscal Year 1968 and Estimates for Fiscal Year 1969" (U.S. Department of Agriculture, Research Program Development and Evaluation Staff 1969).

[3] From "Inventory of Agricultural Research, FY 1983" (U.S. Department of Agriculture, Cooperative State Research Service 1984).

[4] Assistant professors and higher ranks.

The number of research faculty increased by only 80 percent over this 15-year period. But this was extremely important in adding to the universities' permanent bases of talent and maximizing the efficient use of these personnel by providing them with adequate numbers of technicians and graduate assistants and sufficient operating budgets. For example, in 1964 only 164 graduate students

were receiving McIntire–Stennis support; by 1975, the total had risen to 641 (Association of State College and University Forestry Research Organizations 1976).

This expansion in the permanent research base also made possible growth in special grants. As every research administrator knows, qualification for special grants and contracts requires some permanent minimum critical mass of research talent and capability. In my opinion, McIntire–Stennis was the key shot in the arm in establishing this permanent minimum critical mass that made the southern university programs more competitive in the special grants arena. Here again, table 5 shows rates of growth from these sources well above the growth in McIntire–Stennis funding itself.

McIntire–Stennis also stimulated the universities to greater cooperation and collaboration in research. In 1963, the McIntire–Stennis Institutions formed the Association of State College and University Forestry Research Organizations (ASCUFRO) to "exchange information, form acceptable policies and cooperate in developing and conducting research in the United States" (ASCUFRO 1976). This led to the schools becoming represented in the USDA–State agricultural experiment stations' regional and national research planning system in partnership with the USDA Forest Service. The schools also secured representation on research policymaking committees of the National Association of State Universities and Land-Grant Colleges. More recently ASCUFRO merged with the Council of Forestry School Executives (made up of public *and* private schools) to form the National Association of Professional Forestry Schools and Colleges (NAPFSC). Thus, all university forestry programs now speak with one voice and are represented in policymaking concerning resident instruction and extension and on research committees of larger organizations (National Association of Professional Forestry Schools and Colleges and USDA Cooperative State Research Service 1985).

Case Examples

As stated earlier, I found no aggregate assessments of benefits to the forest resource or forest industry from southern university forestry and forest-products research. Thus individual case examples must serve as indicators.

Examples cited previously had early beginnings. Those that follow are largely products of the post-McIntire–Stennis period except for two of the three tree-improvement cooperatives.

Those cited include by no means all programs that have had

significant impacts on productivity, profitability, or policy. They are simply samples to illustrate the diversity of the contributions made by southern university research. For the most part, examples are limited to programs which have been established long enough for results to be transferred to and applied by, users.

Forestry

Genetics and Tree Improvement—Large-scale tree-improvement research and development have been carried out through university–industry–State forestry organization cooperatives at Florida, North Carolina State, and both the Texas Forest Service and Texas A. & M. The 29 cooperators in the North Carolina State program have planted 3,000,000 acres with genetically improved stock estimated to produce a 7- to 12-percent increase in cubic volume yield when trees reach 25 years of age over yields from woods-run source material. On Site Quality 60 land, the increase in after-tax stumpage value per acre is estimated to run from $242 to $434 ($598 to $1,072 per ha) with an increase in investment costs of $4.79 to $15.46 per acre ($11.84 to $38.20 per ha) depending on seed-orchard yield levels. After-tax rates of return on investments in tree-improvement programs are estimated to range from 14.25 to 19.75 percent (Talbert et al. 1985; Weir, personal communication). Members in the North Carolina State and Florida cooperatives are now producing enough improved stock as a whole to be self-sufficient; members of the west gulf cooperative at Texas A.&M. are now meeting half of their annual planting stock requirement with genetically improved stock (Weir, Goddard, and van Buijtenen and Lowe, personal communications).

Nursery Management—Nineteen forest-industry companies, 12 State forestry organizations, and 1 USDA Forest Service nursery—in the aggregate some 90 percent of the South's forest-tree nursery production capacity—belong to the Auburn University Southern Forest Nursery Management Cooperative. Application of research on weed control is saving cooperators a total of $2.25 million annually in costs for hand weeding and mineral spirits. Seven of nine herbicides now in use were registered as a result of Cooperative research. Development of improved fungicides has reduced losses of planting stock to fusiform rust from as high as 20 percent to one-half of 1 percent (South and Gjerstad 1985 unpubl.; South, personal communication).

Forest Fertilization—Cooperatives were established in this research area at the University of Florida in 1967 to focus mostly on slash pine and at North Carolina State in 1979

to focus on loblolly pine. Regionwide tests have shown that fertilization at planting, particularly on wetter sites, increases growth and yield by 30 to 40 percent over a 15- to 20-year period; returns on investment range from 10 percent to 15 percent. Such fertilization on many wetter sites often makes the difference between survival and no survival and thus, in effect, has added area to the commercial pine production base.

"Catchup" or midrotation fertilization effects were found to last for 5 to 8 years with similar growth and yield response. Returns on investment ranged up to 20 percent for companies growing trees for a combination of several products.

Slightly over 1 million acres (404,700 ha) had been fertilized up to 1981 in the southeastern Coastal Plain (Stone 1983; Cooperative Research in Forest Fertilization 1983; Allen, personal communication).

Plantation Growth and Yield and Management—There are four cooperatives working in this area—at Georgia, VPI and SU, Mississippi State, and, most recently, Stephen F. Austin. All four programs have involved large-scale, permanent field plot systems to determine growth and yield of planted loblolly pine, or loblolly and slash pines, on site-prepared lands under varying intensities of site preparation in combination with other cultural practices.

The first of these was established in 1976 at the University of Georgia under landership of Jerome Clutter, who was the cornerstone for what was generally recognized as a center of excellence in forest biometry. His graduate students have gone out to establish effective programs elsewhere. One such program is at VPI and SU, where Harold Burkhart leads a cooperative that has developed a model for determining the impact of hardwood competition on pine plantation yield and profitability. Burkhart's team found that a 10-percent reduction of crown competition within lower ranges of such competition added $150 to $160 per acre ($371 to $395 per ha) to the net present worth of such plantations based on forest industry cooperators' figures. Some 100,000 acres (40,470 ha) per year are now being treated by cooperators with plantation value increases totaling some $15 million annually (Bailey and Burkhart, personal communications; Burkhart and Sprinz 1985).

Insect and Disease Protection—In Texas, Stephen F. Austin State University and Texas A. & M. forest entomologists, in cooperation with the USDA's Expanded Southern Pine Beetle RD&A Program, developed a system for hazard rating of East

Texas pine forests according to likelihood of infestation by southern pine beetle. The system is used operationally by the Texas Forest Service in determining priorities for continuous monitoring for early recognition and control (Adair and Walker, and Lee, personal communications). Texas A. & M. developed an economic threshold simulation model for individual beetle infestation situations, which is paired with a decision tree to guide control decisions. The technology is now being transferred to State forestry organizations through the South for application (Merrifield, personal communication).

Mention has already been made of Auburn's research to nearly eliminate nursery stock losses of pine seedlings to fusiform rust. This organism has received much research attention elsewhere. University of Florida forest pathologists and geneticists have studied its epidemiology and the heritability of resistance, and have identified 100 slash pine clones with both good growth and rust resistance characteristics (Stone 1983). In 1981, an Integrated Pest Management Cooperative with nine forest industry companies and one State forestry organization was established at Florida to expand research on this and other pest organisms (Schmidt, personal communication). At Louisiana Polytechnic Institute, Fred Jewell is nationally recognized for long-term basic research on the mechanism of infection and the mechanism of resistance to fusiform rust and gall rust (Verrall 1982).

Systems Management and Decisionmaking—Forest economists and biometricians at southern universities have combined mathematics, operations research, mensuration, and the computer to produce models for decisionmaking in managing forest systems. One that has had widespread application is the MAXMILLION model developed by Jerome Clutter and his associates at Georgia under a cooperative with 10 forest-industry companies. They produced a major linear programming model for planning the scheduling of forest operations to optimize returns on investment or to minimize costs. In 1975 they tested it against conventional planning methods on forest-industry tracts in Florida and Mississippi. It boosted timber productivity by 5 to 7 percent and increased returns on investment by 14 to 16 percent. The model is now used throughout the South by a majority of forest-industry companies that own, or control through leases, some 26.7 million acres (10.8 million ha) (Bailey, personal communication; Southern Forest Institute n.d.).

Environmental Protection—Under section 208 of the Federal Water Pollution Control Act of 1972, each

State is required to develop best management practices (BMP's) to minimize pollution from nonpoint sources such as forestry and farming operations. Southern university forestry research at several institutions provided data bases, in whole or in part, for selecting and verifying the effects of such practices.

The Arkansas Forestry Commission used some of the data from research on effects of silvicultural practices and different intensities of management on water quality and wildlife habitat. The research was a three-way effort between the University of Arkansas at Monticello, the USDA Forest Service, and Weyerhaeuser. Oklahoma State University was similarly engaged (Blackmon, personal communication).

Years of research at the University of Tennessee on the ecology, silviculture, and management of oak–hickory and oak–pine forests culminated in publication by the Tennessee Forestry Association of "Forest Practice Guidelines for Tennessee." Edited by University faculty, it constitutes the BMP's for 208 compliance in Tennessee (Tennessee Forestry Association n.d.; Schneider, personal communication).

In the lower Coastal Plain, the University of Florida's School of Forest Resources and Conservation and the USDA Forest Service, with forest industry cooperating, established the Intensive Management Practices Assessment Center (IMPAC) in 1976 to conduct comprehensive impact research on effects of intensive forest management systems on soil, water, and wildlife resources. Some of the early results have provided part of the basis for Florida BMP's (Coleman et al. n.d.).

Timber Harvesting—Research to improve timber harvesting equipment, methods, productivity, and management has been carried out at a number of southern universities with significant results. For example, Mississippi State developed one-pass and two-pass harvesting systems for picking up green woody biomass left behind in pulpwood and sawtimber logging. The systems make it possible for forest-products companies to increase use of woody biomass for fuel by 25 tons per acre (62 tons per ha) at a delivered cost competitive with alternative fuels. And the removal of this additional material has reduced costs of site preparation for the next crop by as much as $60 an acre ($148 per ha) (Richards, personal communication).

VPI and SU has an Industrial Forest Operations Cooperative with 10 forest-products companies, three harvesting companies, and the USDA Forest Service's Forest

Engineering Laboratory as members. Its purpose is to support expanded research and continuing education in harvesting. An early research result was the refining of a model initially developed elsewhere under American Pulpwood Association auspices for evaluating new or modified equipment in terms of production and production-cost rates. This model can also be used for ranking combinations of equipment or systems for harvesting a particular stand, or for ranking given systems for harvesting a variety of stands. Twenty pulp and paper companies now use the computerized model to advise their producers or contractors on equipment selection and system balancing. Equipment manufacturers use it to evaluate prototype machines (Walbridge, personal communication).

Forest Products—In forest products, a very considerable amount of research has been designed to improve kiln drying. The Mississippi State University Forest Products Utilization Laboratory developed a high-temperature system for drying heavy timbers, poles, and piling before preservatives are applied that cut drying times from 5 days to 2. This more than doubled the capacity of kiln systems in use (W. Thompson, personal communication). At the University of Tennessee, research has reached the pilot-testing stage for a computerized control system of kiln operation to minimize degrade of oak lumber (Schneider, personal communication). VPI and SU has carried through the prototype-test stage a computer-controlled automated kiln operation system that monitors temperature drop across the charge and continually adjusts the kiln schedule. It saved $200,000 per year in degrade reduction for an investment of $100,000 (Ifju, personal communication).

In the 1960's and 1970's, North Carolina State was involved in lumber drying and yield optimization research to improve raw material use by the southern furniture industry. This endeavor included the development of furniture-cutting yield-prediction tables and a prototype machine for maximizing the yield of such cuttings from lumber used. Cooperating companies have reported savings of 5 percent to 20 percent in lumber requirements. A 10-percent saving industrywide would provide a combined raw material cost reduction of $84 million annually (North Carolina State 1985 unpubl.).

In other areas, the Mississippi State Laboratory, in cooperation with the American Plywood Association, investigated the use of soft hardwoods such as yellow-poplar, black gum, and red maple as veneers in structural grade plywood. Scientists found that any combination of these species, or

these species with pine, met American Plywood Association standards. The association followed up by broadening standards to permit use of these species. Industry adopted the new standards quickly at annual cost savings of up to $1 million per plywood plant (W. Thompson, personal communication).

The William H. Sardo, Jr., Pallet and Container Research Laboratory at VPI and SU was built in 1976 with funds provided by the National Wooden Pallet and Container Association. It serves an industry made up of 3,000 to 4,000 manufacturers in the United States. They collectively consume more than 50 percent of total hardwood lumber produced, to manufacture more than 400 million pallets annually. This post-World War II development is estimated to save the average American consumer $500 per year because of reduced materials handling and distribution costs. The laboratory is the only one of its kind in the world.

With major funding from the association, VPI and SU, and the USDA Forest Service's Forest Products Laboratory and Northeastern Forest Experiment Station, and with major research participation by these Forest Service units, the laboratory developed a computerized system for customized pallet designing. This uses materials, pattern, and use characteristics as input variables and predicts life expectance, total costs, and cost per handling trip as outputs. The system is offered to pallet manufacturers on a subscription basis and has been enthusiastically accepted by the industry (Ifju, personal communication).

North Carolina State established its Reuben B. Robertson Pulp and Paper Laboratory for teaching and research in 1956. It is the only facility of its kind in the South (Saylor 1979). Basic and applied studies completed recently have produced information on the use of oxygen rather than chlorine in the pulp bleaching process. Some 20 pulp mills worldwide have installed a bleaching system based on this research. It reduces water pollution and also reduces chemical costs by $15 per ton of pulp. For a typical southern 1,000-ton-per-day mill, the saving will amount to $5,475,000 per year. The system can be installed in most mills without major overhaul of the bleach plant (North Carolina State University 1985 unpubl.).

Basic Research—Basic research is research that is not immediately applicable except to other research (and sometimes not then). Since this publication is an impact history, the subject will be mentioned only briefly.

Basic research needs to be recognized for several reasons.

First, without it, meaningful and successful applied research would quickly reach the limits of knowledge and new approaches. Second, it is perhaps best conducted in universities rather than by more specific mission-oriented organizations. In universities, faculty usually have more freedom to pursue lines of inquiry of their own choosing. And major universities offer diverse opportunities for multidisciplinary and basic science collaboration that simply do not exist elsewhere for the most part.

Some interesting and significant basic research has been and is being conducted by southern university forestry and forest-products program units. Early work at Mississippi State on nutrient cycling in pure pine stands and oak–hickory–pine climax stands provided a foundation for large-scale applied research on forest fertilization and its acceptance by southern forest managers (Richards, personal communication). Work on the basic biology, behavior, and population dynamics of southern pine beetle at several southern universities was absolutely necessary for development of more effective control techniques and strategies. At Oklahoma State University and Stephen F. Austin State University, research on the physiology of drought resistance led to higher success in planting droughty areas (Walker 1981; Adair, personal communication). Duke University is known for long-term work on plant growth–moisture relationships and the effects of water stress on plants, and for work on radiant energy balances (Jayne, personal communication).

Tissue culture and genetic engineering are currently the glamor areas of basic research. And forestry scientists at southern universities are deeply involved. Claude Brown, at the University of Georgia, was the first to vegetatively propagate pine seedlings in test tubes (Hargreaves, personal communication). North Carolina State established a tissue culture cooperative in 1979—a joint venture of the School of Forest Resources, the Department of Botany, and 14 forest-industry companies. A major goal is finding a cost-effective system for vegetative propagation of pine species. This would open the door to doubling genetic gains from one generation to the next and getting into mass production of improved strains in 3 to 4 years instead of 12 to 15. In the long run, this research could also open the door to gene-splicing to permit moving genes that control fusiform rust resistance in shortleaf pine to another species, for example, loblolly pine. A method for transferring genes in pine utilizing two strains of bacteria has already been patented by the North Carolina State botany genetics

faculty with collaboration from an Oregon State University researcher (Sederoff, personal communication).

Basic research in forest products is also going forward. Clemson and Mississippi State are involved in studies for turning wood into liquid form for coating wood products and for making artificial skin for burn victims (Box and W. Thompson, personal communications). Texas A. & M. is working on developing liquid fuels from wood cellulose (Lee, personal communication). Stephen F. Austin has developed a 4-minute, high cellulose yield, continuous pulping process that is ready for pilot plant testing (Adair and Walker, personal communications). Auburn has developed a theoretical model for predicting the durability and reliability of wood composites used in wooden I-beams, and is conducting research on the effect of intracellular wood preservatives on strength properties (E. Thompson, personal communication). VPI and SU has been nationally recognized for quantitative microscopy characterization of wood structure as a basis for predicting strength properties and performance (Ifju, personal communication).

These programs are keeping forestry and forest-products technology and research at the cutting edge of modern science.

The extension program has been the least understood and appreciated of land-grant university forestry and forest-products programs. The reasons are several—its informal education role, its unique underlying philosophy and organizational structure, the diversity and complexity of its internal and external relationships, the diversity of educational methods it employs, and the low level of staffing and support it has been given until quite recently.

Role and Philosophy

Cooperative Extension is the offcampus arm of the land-grant university. Its role has been to help people help themselves through

- Informal yet designed educational opportunities;
- Problem-oriented education to improve understanding, motivation, and decisionmaking;
- Serving as the interpretive link to transfer to users new and useful technology developed through land-grant university and other research; and
- Providing factual and credible information to the public to improve public decisionmaking at community and higher levels.

Finally, extension provides feedback to researchers regarding results of application and new or emerging research needs developing in the field (Extension

Committee on Organization and Policy 1976, Wade 1975 unpubl.).

Note the phrase, "to help people help themselves." This has been the core of extension's philosophy and approach. Extension's first concern has been the welfare of the individual client, client family, or client firm. Its societal welfare model has been that of Adam Smith—that society will be best served by the aggregate impact of each individual seeking to optimize his own situation. In agriculture, the result of this approach has been a food-production system that is the envy of the world—one in which the major problem is dealing with surpluses, not shortages.

Extension people, then, have been "people-people," not "thing-people." Though he did not use my terms, Robert Keniston (1975) spoke to the need for such an approach.

> There is an implicit assumption that every tract of woodland can be made to produce the wood crops it is capable of as soon as foresters succeed in pointing out to the owner the error of his ways. Then since he presumably accepts the silvicultural ideal, or thinks and feels as the "economic man" should, he will "see the light" and practice constructive timber forestry. The optimum allocation of *all* resources (including human) [italics mine] from an economic or social point of view is evidently disregarded.
>
> What is best for forestry is not necessarily best for the individual, or for the nation.

Organization and Relationships

As stated earlier, Cooperative Extension has been a three-way partnership of the USDA, the State land-grant universities, and county governmental units, with funding from all three. This partnership has required that local people be involved in program planning and that State and national needs also be considered. Nationally, Cooperative Extension has served, in part, as USDA's lead educational agency (Extension Committee on Organization and Policy 1976, Wade 1975 unpubl.).

The grass roots line unit is the county extension staff and program. Until recently, there have been few professional foresters in county positions or in multicounty or area agent positions. Most county staff have had agricultural, home economics, or community development backgrounds.

Forestry and forest-products professionals have been in State or

multicounty area staff specialist positions. Extension specialists have no line authority over county staffs, although in forestry, program implementation is with and through them for the most part. Forest-products specialists tend to work more directly with clients and client firms. Thus educating and persuading county extension staff to (1) recognize program needs, opportunities, and promising solutions; and (2) mount appropriate programs at the county level have been a major responsibility of the specialist in forestry (Wade 1975 unpubl.).

Relationships have varied among specialists and forestry and forest-products academic units. Where extension was conducted within this unit, the academic unit administrator usually shared administrative responsibility with the State extension director. Where the operation was separate, the specialist staff answered primarily to the State Extension Administration (Extension Committee on Organization and Policy 1976).

External relationships are diverse, extensive, ad hoc, or permanent, as indicated earlier, and will not be discussed further here. Case examples to be cited later will help illustrate their nature.

Methods

All educational methods have been used. Selection has depended on the client's needs, state of knowledge, and individual situation; the type of information to be communicated; the degree of tailoring required; and other factors. Both group and one-on-one approaches have been employed.

In earlier times, extension relied heavily on field method demonstrations and result demonstrations to introduce new and improved practices. These demonstrations were located on clients' properties or at their facilities. Efforts were made to identify local leaders with influence among their peers to act as demonstrators.

The method demonstration was just that—a show-how and practice event at a meeting on a property where the practice or practices could be applied advantageously.

The result demonstration went further in that it involved collecting, keeping, analyzing, and publicizing comparative cost and performance data over the response period.

Extension staffers selected the demonstration method in light of the old learning theory that people remember 10 percent of what they hear or read, 30 percent of what they see, and 70 percent or more of what they do. The demonstration method is still extensively used. But today the whole gamut of media and

techniques is employed in implementing modern extension programs.

Program Scale

A final reason why extension forestry and forest-products programs have been unappreciated is that they have been starved to death in the past by the shakers and movers of southern agriculture and forestry. For years many States had one, or sometimes two, professional foresters at most as State-level specialists and none in county extension positions. I can recall oldtimer A. S. McKean expressing this predicament in 1951 most colorfully when he remarked at a Society of American Foresters meeting that, "One extension forester in a State can only rattle around like a buckshot in a bass drum."

Even today in the South, there are only 84[2] full- and part-time forestry and forest-products professionals employed as State or area specialists or as multicounty agents. A number of these are on soft money. And in early 1985, 5 of the 12 Southern States had total staffs of 4 or fewer (Neal 1985). But there are definite signs of growth in this area at last.

[2] This figure excludes wildlife, fisheries, etc., and academic unit heads with part-time appointments.

During the Lumbering Period

> Timber has paid off more mortgages on cotton and tobacco farms than cotton or tobacco ever have.
>
> Why not grow some timber while you wait? You're going to wait anyhow.
>
> You say you've already worn out and moved off of three farms already, so what can I show you about farming? Maybe I can show you how you can stay on this one.
>
> —Robert W. Graeber

Robert Graeber was one of the South's pioneer extension foresters. He served North Carolina from 1925 through 1949 after 13 earlier years as a successful county agent.

Graeber was tough minded, aggressive, dedicated, colorful; and, as the above quotes demonstrate, he knew farmers and how to relate to them. He and his fellow pioneers needed all these qualities, for pioneer extension workers were not exactly greeted with open arms. During the early development of the land-grant university in his State, one farmer is reported to have asked, "What you goin' to do with that college up there? Larn 'em to rake harder?" (Beale 1974).

Graeber himself could recall instances where farmers turned their dogs loose on county agents to run them off. Caudill (1963) described the early days of agricultural extension in the Cumberland Plateau of eastern Kentucky as follows:

> For approximately 16 years in most counties—from 1925 to 1941—the agents worked zealously to break the old and ruinous pattern of land use and abuse. Stony silence and contempt were often their reward. Sometimes they were openly ridiculed and at least one was beaten by a farmer who "already knowed how to farm." But by slow degrees a change of attitude began to assert itself.

But then—nobody had promised them a rose garden.

During the lumbering period (1880 to 1930), extension forestry efforts focused on farmers, beginning after passage of the Smith–Lever Act of 1914. This law authorized allocation of Federal funds on a matching basis to the States to establish agricultural extension programs to carry useful and practical information on agriculture to rural people and secure its application. The act put county agents in the field and provided funds to employ specialists to assist them. It established the land-grant program in agriculture, including forestry, as a triumvirate of teaching, research, and extension (Anderson 1922, Beale 1974, Extension Committee on Organization and Policy 1976, National Association of State Universities and Land-Grant Colleges 1978).

Yet not much was done in forestry. Although county agents were active at times in Louisiana, Mississippi, South Carolina, and Tennessee, North Carolina appears to have been the only State to employ an extension forester by 1924 (Maughan 1939, Gillett 1947 unpubl., Keller 1979).

Most Southern State programs got underway following passage of the Clarke–McNary Act of 1924. Section 5 authorized allocation, on a matching basis to the States, of Federal funds earmarked to provide forestry aid to farmers "through advice, education, demonstration and other similar means." This act stimulated the appointment of the first full-time professional extension foresters by the mid-1920's in most Southern States, although Louisiana did not add one until the 1930's, and Oklahoma, not until 1940.

Though extension foresters were few in number, they got things done. During the 3 years that he was employed in South Carolina, Henry Tryon headed a crusade for forest-fire protection that led

directly to the establishment of the South Carolina State Commission of Forestry in 1929 (Bruner 1967 unpubl.). Similarly, in Arkansas Charles Gillett took advantage of a disastrous fire season in 1930 to develop a booklet and campaign to dramatize the economic losses it caused. This booklet had much to do with building public interest and pressure, which led to the establishment of the Arkansas State Forestry Commission by the State legislature in 1931 (Widner 1968).

North Carolina and Tennessee farm forestry extension reports for the years 1926–37 indicate types of early activities and accomplishments. Here is Graeber's statistical report for 1930 (Maughan 1939). He was working alone in that year; he did not have an assistant until 1935 (Keller 1979):

Method demonstrations held:	
Timber thinning	33
Selective cutting	3
Timber estimating	6
Tree identification	2
Result demonstrations established:	
Timber thinning	26
Selective cutting	3
Planting	11
Attendance at demonstrations	1,030
Attendance at other educational meetings	6,137
Black walnut seedlings placed with 508 individuals	17,760
Other forest tree seedlings placed with 15 individuals	25,100
Radio talks	2
News articles	60

During the South's Second and Third Forest Periods

The 1930's brought in Franklin D. Roosevelt and his New Deal. Establishment of the Civilian Conservation Corps, Tennessee Valley Authority, Soil Conservation Service, and the conservation cost-sharing programs of the Agricultural Adjustment Administration for tree planting, timber-stand improvement, and naval-stores conservation practices led to a great upsurge in soil, water, and forest conservation interest and participation.

Extension foresters collaborated with and used these programs to expedite and expand improved farm forest management. Tennessee is a good example. In the 1930's, extension forester George Shivery started using the Tennessee Valley Authority's unit test demonstration farms as sites for farm forest management result demonstrations, as did extension foresters in the other Tennessee Valley States, then and later.

Shivery utilized State Division of Forestry CCC camp crews to establish cooperative timber-stand improvement demonstrations on the Cumberland Plateau. In 1937, he reported an increase in timber-stand-improvement activity and in forest-tree plantings as a result of the Agricultural Conservation Program's cost-sharing provisions (Maughan 1939).

In 1937, the Norris–Doxey Cooperative Farm Forestry Act was passed to strengthen cooperation with the States in farm forestry extension and provide intensive technical assistance to farmers in forest management, harvesting, and marketing. The technical assistance phase was initially under the Soil Conservation Service. Under this act, Federal funding for farm forestry extension nearly doubled. Nationally the act allowed 31 States to add a second professional to extension forestry programs (Clepper 1971, Wade 1975 unpubl.).

In 1943 and 1945, the USDA Forest Service took over from the Soil Conservation Service the technical assistance phase, initially conducting technical assistance through either State forestry organizations or State agricultural extension services. In States such as Alabama, Louisiana, and North Carolina, where the State extension service served this role, six to eight farm foresters were added to the extension forestry staffs. These people each provided one-on-one timber marking, estimating, and marketing services to forest landowners in three to four counties.

Extension was written out of this program by the Cooperative Forest Management Act of 1950, which specifically directed the Secretary of Agriculture to cooperate with State foresters in providing technical services to forest landowners and primary timber processors (Extension Committee on Organization and Policy 1976). But Norris–Doxey had some very positive effects. It created an increased awareness of forest values. In effect, it put the dollar sign into forestry in the minds of many landowners. It created an appreciation of the value of professional forestry assistance and service, thus opening doors for State service forestry and consulting forestry. It demonstrated that harvesting timber (other than through clearcutting to a 10-, 12-, or 15-inch stump diameter limit) was both practical and profitable. And it brought the larger State forestry organizations into the nonforest industry/private forest owner assistance field. Prior to Norris–Doxey, these organizations had invested most of their attention, resources, and political clout in building up forest-fire protection systems (Gillett 1947 unpubl.).

In 1949, the Clarke–McNary Act was broadened, and the Federal authorization for farm forestry extension cooperation was increased from $100,000 to $500,000. This was the climax (until 1978) of statutory and funding support for extension forestry. And this earmarking was lost in 1955, when Clarke–McNary was abandoned and the $85,000 Federal allocation in that year was transferred to the general agricultural extension authorization and appropriation under Smith–Lever (Wade 1975 unpubl.).

As a result, from 1951 until 1978 the growth of extension forestry was slow in terms of staff and funding (Wade 1975 unpubl.). Forest-products extension was an exception. Passage of the Research and Marketing Act in 1954 made Federal funds available to State agricultural extension services for work with processors of agricultural products, including timber.

North Carolina was the first State to take advantage of this new funding. A wood-products extension staff of three specialists was set up there in 1957. In 1959, this group received a 3-year contract from the USDA Extension Service to conduct a programmatic research and development pilot program with wood industries. The program included preparing teaching materials, testing approaches and methods, training extension personnel in other States, and providing followup consultation to them as they got programs underway. By 1979, 28 States (including several in the South) had begun programs based on this model. Most were initiated in the 1960's (Keller 1979).

Other Post-World War II Program Thrusts—Like the schools, extension foresters were involved in programs to train and retrain veterans in the late 1940's. Many who intended to farm signed up under the GI bill for training through secondary school vocational agriculture departments. This was a readymade captive audience for extension forestry. Extension foresters were heavily involved as guest instructors at evening classes and in field demonstrations training veterans in farm forest management, harvesting, marketing, and home use of forest products.

The 1950's and 1960's saw rapid expansion in pulpwood demand and marketing systems, including the development of cash buying yards. The industry itself got into landowner education and assistance through the Southern Pulpwood Conservation Association and through individual company conservation forestry programs. The new market system, plus the development of lightweight power saws and other equipment, made thinning and timber stand improvement

commercially feasible on a much larger scale on both a stumpage and landowner self-harvesting basis.

The Conservation Reserve Phase of the Soil Bank Program in the 1950's, combined with development of relatively inexpensive mechanical tree planters and conservation contractor vendors, created a boom in planting surplus cropland to trees. The 1950's and 1960's also witnessed development of heavy-equipment systems and effective herbicides for preparing and replanting or reseeding of cutover land and conversion of low-grade hardwood sites to pine. In 1973, the initiation of the Federal Forestry Incentives Program followed by supplementary State programs in Virginia, Mississippi, North Carolina, and South Carolina, and a private program in Texas provided expanded cost-sharing for site preparation, planting, and other productivity-increasing practices (Warren and Wiseman 1985).

All of these developments, plus price increases for timber, resulted in a greatly improved climate for nonindustrial private forestry in the South. Along with that came the mechanization of harvesting, the development of log debarking and chipping, whole-tree chipping, chip-n-saw systems, lamination, particleboard, southern pine plywood, new wood preservatives, new glues and finishes, and the application of operations research models and computer controls to wood processing operations.

In most Southern States, extension foresters, forest-products specialists, and county agents played a central role in making forest landowners, loggers, processors, and, in some cases, consumers aware of the new opportunities and how to take advantage of them. These professionals sponsored or cosponsored a host of demonstrations, field days, tours, logging equipment shows, demonstrations of naval-stores conservation practices, and use of newsletters, publications, the press, and radio and television.

The period after World War II was also one of major growth in 4-H forestry programs. Special 1-week training camps were created. 4-H demonstration forests were established near schools. Comprehensive county, district, and State competition and award programs were founded. The programs enjoyed support and cosponsorship of the forest industry, forestry associations, and certain public utility companies.

The Renewable Resources Extension Act of 1978—Passage of this act gave forestry, forest-products, and related natural-resources extension a separate, comprehensive, yet

specific charter of responsibility, and earmarked Federal funding authorization for the first time in its 64-year history. It specifically directed the Secretary of Agriculture to cooperate with State extension directors to

- Provide educational programs that would enable individuals to recognize, analyze, and solve problems dealing with forest and related resources;
- Develop educational programs that give special attention to the needs of the small, private, nonindustrial forest owners;
- Help forest landowners secure technical and financial assistance and appropriate expertise;
- Conduct educational programs to transfer the best available technology to managers, processors, and other users;
- Assist in providing continuing education programs to professionally trained individuals in forest management and related fields;
- Disseminate results of research; and
- Help identify area of needed research (USDA Forest Service 1983).

Annual Federal appropriations were authorized up to a maximum of $15 million with no matching requirement.

Although the annual appropriation had reached only $2.5 million by fiscal year 1985 and was soft money (not included in the President's budget to Congress), the act was a real stimulus for extension forestry and forest products across the board.

The South annually received an additional $600,000 to $700,000 in Federal funds under this act. Although there was no State matching requirement, this figure has been more than matched by State and, in some cases, industry support. From 1978 to 1985, the number of professionals employed in natural resources fields as specialists and area agents increased from approximately 60 to 100 (Neal 1985 unpubl.).

New initiatives were made possible. At the regional level, the Southern States began collaborating in a well-planned campaign to expand pine regeneration on the basis of getting nonindustrial private forest owners to recognize competitively advantageous investment opportunities where these, in fact, existed. This involved preparation of regional investment guide materials and the training, at State levels, of professional foresters advising such owners in their use. Special emphasis was placed on forest planting on marginal agricultural lands (Neal, personal communication).

At State and multicounty area levels, newly employed professionals brought needed specialized expertise to make

possible new initiatives not only in pine regeneration and investment analysis but also in timber harvesting and procurement improvement, the use of microcomputers, and other areas (Neal, personal communication).

At long last, a minimum critical mass of professional talent was on its way to being assembled in at least 9 of the 12 Southern States, where it existed in only 1 or 2 before. Perhaps extension forestry finally will be able to do its share of beating the forestry drum instead of just rattling around inside it.

Aggregate Measures of Program Impact

I found only two evaluations of aggregate impact of extension programs in forestry. Both were national in scope.

In 1979–80, the Mississippi Cooperative Extension Service, under Federal contract, conducted an evaluation of 10 extension program areas. One of these was the small woodlands programs. Seventeen States were sampled, including six in the South. Aggregate results were reported by the Oregon State University Extension Service (Krygier 1980).

A total of 344 landowners and firms who had participated in a variety of extension programs were the sample population; 244 of these responded to questionnaires. Some of the findings follow:

- 72 percent or higher rated the value of programs as "much" to "great" in terms of relevance to their own objectives, help in recognizing opportunities, help in pursuing such opportunities;
- 54 percent indicated that their participation had "much" to "very much" effect on decisions to increase investments in forest management; and
- 86 percent felt that participation had helped them to maintain or increase personal income (an average increase of 16 percent was indicated).

For 4-H forestry, in 1980 the National 4-H Natural Resources Committee conducted a survey of both 4-H Club alumni and current 4-H members who had participated in 4-H natural resources programs. A total of 142 people from 21 States responded to a 10-question questionnaire; 86 of these were alumni and 56 were current enrollees.

Results (National 4-H Natural Resources Committee 1981 unpubl.) were as follows:

- 58 percent felt that the greatest value of their participation was that it increased their awareness, appreciation, and understanding of natural resources;
- 24 percent of 41 alumni attending college who responded were majoring in a natural resources field;

- 43 percent of 46 current enrollees responding who planned to attend college intended to major in a natural resources field.

Aggregate activity levels are measures of effort, not impact. They are listed here simply to indicate the recent scale of extension forestry and extension forest-products activity in the South. The following were reported for 1982 for the 12 States included in this study plus Kentucky (Neal 1983 unpubl.):

Private woodland owners' meetings	603
Private woodland owners reached	23,591
Meetings for loggers	38
Number of loggers reached	1,985
County forestry clubs or associations formed	131
County agents' in-service training sessions	82
County agents reached	1,678
Meetings for professional foresters	739
Professional foresters reached	1,806

Case Examples

Here are a few examples of programs not cited previously to further illustrate program diversity and impact.

Forestry

Investment Analysis, Income-Tax Provisions, and Microcomputer Applications—At least 8 of the 12 Southern States have emphasized financial analysis through use of microcomputers in regeneration, forest management, and in some cases harvesting management in recent years. Florida extension specialists have developed FORINSYS (Forest Information System), a 12-module computer program and data base for investment analysis and technology transfer. It is available through a computer network of extension offices in 32 of Florida's 67 counties (Flinchum 1983 unpubl.). Clemson helped modify the Tennessee Valley Authority computer program WOODPLAN into YIELD, which is more user friendly. It is now available in every county extension office in South Carolina. The Clemson extension foresters also developed and published a cookbook procedure to follow in comparing returns on investment in forest regeneration enterprises with other alternatives. It has gone through four printings, and 100,000 copies have been distributed throughout six States (Kessler, personal

communication). Georgia has emphasized regeneration investments, particularly on marginal cropland, by providing comparative investment information by soil series for pine reforestation versus corn and soybean enterprises (Gunter, personal communication). VPI and SU estimated an aggregate forest management and harvesting productivity increase of $850,000 as a result of short courses, workshops, and other meetings for 3,700 landowners, foresters, loggers, and others in fiscal year 1984 (Haney 1984 unpubl.).

Urban Owners of Rural Land—Georgia and Texas extension foresters have made special efforts to reach nonfarm owners of forest land who live in major urban areas. These people have become the majority among nonindustrial private forest owners in some States (for example, Georgia). Georgia extension foresters are holding seminars at individual forest industry corporate headquarters in Atlanta along with 1-day bus tours to get owners into the field. One such seminar drew 350 people from four adjoining States, who owned land in 10 States (Gunter, personal communication). Texas has had such a program in the Dallas and Houston areas since 1968 and has an extension specialist located in Houston. Two night meetings plus a weekend tour have been held annually in each city, with 60 to 70 attending (Walterscheidt, personal communication).

County Forest Landowner Organizations—North Carolina extension foresters first began helping expedite the formation of organizations for nonindustrial private forest owners at the county level in the late 1950's. Today there are county forestry associations in 60 of the State's 100 counties, with a total of 3,000 members who meet three to four times per year with one meeting a field tour. Industry foresters and consulting foresters can participate, but officers generally have to be nonindustrial private owners. These associations have proven to be an excellent means for getting improved forest management on the ground carried out by members, who share their experiences with others as well (Levi and Huxster, personal communication).

4-H Forestry—Early 4-H forestry programs in Mississippi from the 1930's through the 1950's piqued the interest and curiosity of quite a number of smart young people from small farms. They were induced to enter the 2-year preforestry program at Mississippi State (which was later expanded into a full 4-year program). Many transferred to other colleges to finish their bachelor's degrees. Many southern leaders in industrial, State, and Federal forestry got their start in this

program (Foil, personal communication). Mississippi has continued a tradition of excellence in 4-H forestry. Enrollments ranged from 3,800 to 8,300, and five national Best Forestry Record winners were produced over the 1980–84 period (Daniels, personal communication).

County Extension Staff Training and Assignment—Clemson extension foresters began in 1981 to conduct a structured in-service training program in forestry and the development of county extension forestry programs. It involves six 1- to 3-day sessions taken over a period of 2 to 3 years. The effort has received strong backing from the Clemson Cooperative Extension Service Administration, which is expanding the hiring of professionals as multicounty agents in forestry (Kessler and Neal, personal communications). The Georgia Cooperative Extension Service now considers forestry as an acceptable degree in hiring extension agents in the "agriculture and natural resources" personnel category. Some 20 to 25 professional foresters are now employed as county extension staff (Gunter, personal communication). In each of North Carolina's 100 counties, at least one extension staff member has specifically assigned responsibility for the county extension forestry program and is held accountable for it in annual performance evaluations (Levi and Huxster, personal communication).

Harvesting and Forest Products

Harvesting—In 1983, VPI and SU's industrial forestry operations specialist initiated an extension program with procurement foresters and with Virginia's 1,000 or more private logging contractors. In the initial year, short courses and workshops were held on sound business practices and management for loggers. A newsletter for loggers was developed. The program was estimated to have increased productivity of harvesting operations in the first year by $300,000, in part due to reductions in butt log damage from improved shears maintenance (McElwhee 1984 unpubl. and personal communication).

Regional Kiln Drying—For the past 7 years, southern cooperative extension services with extension forest-products specialists have jointly conducted 5-day workshops to train hardwood lumber kiln drying operators and yard and drying supervisors of the southern furniture and millwork industry in theory, modern processes, and monitoring for quality control. Southern States plus Kentucky are cosponsors under a standing committee of southern extension directors. The program is self-supporting through tuition charges. Of the instruction, 90 percent is provided by the seven States that have extension forest-products specialists. Attendance at the 10 workshops already held averaged

47. Approximately 300 different companies have participated. Losses from degrade in the drying process have been reduced by 20 percent to 33 1/3 percent. Total system productivity increases of 10 percent have resulted (Lamb, personal communication).

Wood As an Industrial Fuel—In the mid 1970's, North Carolina State extension forest-products specialists began a program to increase the use of logging and wood-product manufacturing residues as industrial fuel by the brick and textile industries. A combustion engineering specialist was hired on a part-time basis to work one-on-one with plant engineers and managers.

Since 1977, 30 of these nonwood manufacturing plants have switched from oil or natural gas to wood or a combination of wood and coal. They annually consume approximately 630,000 green tons of woody residuals valued at $5 million. This wood replaced the equivalent of 27 million gallons (102 million L) of oil worth $22 million with a 10-percent increase in utilization of mill residues. Cost saving to the participating firms was estimated at $17 million (Jahn n.d. unpubl.).

> A bachelor of science degree is only a license to learn; it is not an honorable discharge for life from the university and from education (source unknown).
>
> Continuing education embraces the concept of lifelong learning, which is the process whereby individuals continue to develop their knowledge, skills, and attitudes over their lifespans—from the cradle to the grave (Hampton, personal communication).

This concept is a very broad one. For adults it encompasses all kinds of goals and activities including learning for learning's sake, the development of hobbies, the acquisition of social graces, and so forth. The focus here will be on those teaching programs at southern universities and technician schools that do not lead to a degree but are designed to maintain or improve the professional or technical competence of forestry and forest-products professionals, scientists, technicians, and certain skilled workers in these fields.

At the professional level, Dana and Johnson (1963) described such programs:

> Programs of postgraduate education intended to

broaden the knowledge of practicing foresters and to keep them up to date on current developments are becoming increasingly common and important. They vary in length from a single day to a few weeks and occasionally last for an entire year. Although the shorter programs are sometimes known as "refresher" courses, their main objective is not to refresh a man's memory of what he may once have known but [has since] forgotten. It is rather to acquaint him with fields he may not previously have studied, to inform him of significant new findings in research and of important advances in forest practice, and to provide opportunity for a free exchange of views and experiences. Programs of sufficient length may carry formal credit, but their primary objective is to increase the competence of the participants, not to enable them to qualify for another degree.

University-Level Programs

Organization—At the university level, most faculty receive their salaries from resident instruction, research, or a combination of the two. Continuing education has been an extra obligation of the academic unit and thus often has to be self-supporting through tuition and other charges. As a result, faculty participation tends to be optional—more so in the non-land-grant than in the land-grant institutions, which have official development responsibilities.

The situation has been different for extension faculty. Continuing education of other professionals, managers, technicians, or special vocational groups has been an important method for carrying out their classical function as "linkers" between research and user in the technology transfer process. It has been an important method for in-service training of county extension staff—another classical specialist function. It has been an indirect means for improving the welfare of nonindustrial private forest owner clientele by increasing the effectiveness of public foresters, consulting foresters, conservation contract vendors, and others who serve them.

Thus organization of continuing education has varied greatly from institution to institution. At some, such as Auburn, it has been left primarily up to extension (E. Thompson, personal communication). At others, such as Clemson, the academic unit conducts certain programs and

extension conducts others (McGregor et al. and Kessler, personal communications). At still others, such as North Carolina State and VPI and SU, there has been a formal standing committee of the academic unit with an extension chairman that jointly plans and executes programs (McElwhee, and Levi and Huxster, personal communications).

The University of Georgia Center for Continuing Education has been an outstanding example of a permanent, full-time program. It was established on the university campus in 1957 by the State with a major grant from the W. K. Kellogg Foundation. In 1969, Leonard Hampton (current director of the center) joined the staff. Hampton was a former extension forestry specialist from North Carolina, with advanced degrees in adult education. Finding little systematic and coordinated planning for forestry, he organized an advisory committee that has evolved into the current 19-member Council on Continuing Education for Foresters. It meets every 6 to 8 weeks to assess needs identified through telephone and mail surveys of the 5,000 foresters on a mailing list, and to assist in developing programs to meet the identified needs.

A total of 800 to 1,000 foresters from seven Southern States have been trained annually through short courses and institutes. Forest industry professionals have been the largest clientele category, with consulting foresters second (Hampton, personal communication).

A second permanent organization for continuing education in the South was the Forestry and Harvesting Training Center. It was established in 1973 initially as a joint endeavor of Louisiana State University, Mississippi State University, and the American Pulpwood Association. Later they were joined by Texas A. & M. and Clemson. Until recently the center was self-supporting through fixed contributions (by 19 forest-industry companies in its peak year) and tuition charges. It was located in various facilities in Mississippi.

Initially the center emphasized 4 1/2-day workshops on harvesting and wood procurement. Attendance was limited to 50 forest-industry personnel. The workshops were offered through Louisiana State's General Extension Division. Later the focus was expanded to include other aspects of forest management. Some 90 training workshops and seminars have been held, with a total attendance of 2,700 since the program started.

Because of declining industry support due to the 1980's building recession and the expansion in continuing education programs elsewhere, the American Pulpwood

Association and the Southern Forest Products Association recently took over this program to operate it for the benefit of their own members (McDermid and Jackson, personal communication).

Cooperation—There has been extensive cooperation among the universities and outside organizations.

For example, in 1940 Lloyd Blackwell (then an industry forester) organized the North Louisiana Group of Foresters as a local chapter of the Society of American Foresters. He has served as chairman ever since, including the 30 years following World War II, when he was the first director of the School of Forestry at Louisiana Technical University. During this time the chapter sponsored 15 professional updating training sessions (Blackwell, personal communication).

At the University of Tennessee, an extension forestry specialist is chairman of the Conservation Education Committee of the Tennessee Forestry Association. Through this, the university's Department of Forestry, Fisheries and Wildlife annually cosponsored between three and six 1- to 5-day workshops (Schneider, and Sharp and Stumbo, personal communications). And at the University of Florida, since 1969 the School of Forest Resources and Conservation has been responsible for the program of the annual spring meeting of the Florida Society of American Foresters. This meeting is dedicated each year to technological updating and professional improvement (Mace, personal communication).

Types of Programs—Offerings to date appear to have been of three types. Here are a few examples of each.

Regularly Recurring Events—One subtype of this is the annual 1- to 2-day symposium, or forum, for the forestry community at large or for members of a specific professional society or trade association (see Florida example above).

Louisiana State University was the first in the South with this type of offering. It held its first annual symposium in 1952 and has done so every year since. Attendance in recent years has averaged 200 to 250. Proceedings are published (Burns and Crow, personal communication). Auburn, Clemson, and VPI & SU have since followed suit.

A second subtype is the highly structured short course or institute designed to serve a particular sector on a continuing basis or offering repeat instruction on specific subjects.

Georgia's "Practicing Foresters Institute," started by Professor Archie Patterson primarily for private consulting foresters, is an example. It was offered nine times through 1984. The Institute has been cosponsored by the Association of Consulting Foresters and the university's Council on Continuing Education for Foresters (Association of Consulting Foresters 1984).

In harvesting, Clemson's Department of Forestry and the American Pulpwood Association cosponsored an annual pulpwood production short course for this industry sector for 18 years (1960 through 1977) (McGregor et al., personal communication).

Duke has had an intensive study program since 1977. The School of Forestry and Environmental Studies offers week-long courses on specific subjects to a combination of practicing professionals and graduate students in residence. Practicing professionals can use these programs (under Duke's "Senior Professional Program" framework) in combination with a semester in residence to qualify for a master's degree. Instructors include resident faculty and practicing professionals who are authorities on the given subject. Some of these outsiders have adjunct faculty status (Gay, personal communication).

Special State-of-the-Art Symposia—These are convened when scientists in a given field feel an overall summary of research results and research in progress would benefit themselves and practitioners. These symposia may be specially called or held at an established, recurring annual forum.

The University of Florida's School of Forest Resources and Conservation has put on both types. In the early 1970's, in collaboration with the forest industry's Southern Forest Disease and Insect Research Council, the USDA Forest Service, and North Carolina State, Florida hosted a Southwide, invitation-only symposium on fusiform rust. The purpose was to review all relevant research and experience on the subject with forest managers, as a basis for coming to a consensus, if possible, on best control strategies. Approximately 10 years later, the school cohosted a similar symposium with published proceedings on the theme of the managed slash pine ecosystem (Stone 1983). And in 1982, it utilized the annual spring symposium of the Florida Society of American Foresters to review all relative findings to that date of its joint (with the USDA Forest Service) Intensive Management Practices Assessment Center program (Coleman et al. n.d.).

But Florida is far from the only university to offer this type of major technology transfer event. Tennessee has held one on yellow-poplar management (Schneider, personal communication). North Carolina State had its own loblolly pine ecosystem symposium. Louisiana State used its 1970 annual symposium to focus on silviculture and management of bottomland hardwoods (Hansborough 1970). The University of Arkansas at Monticello hosted a special state-of-the-art symposium on forestry and water quality in 1985 (Blackmon, personal communication).

Specific Technology Transfer Short Courses and Workshops—Training courses on specific technology were among the earliest continuing education activities in the South. For example, shortly after World War II ended, there was a round of short courses on the application of aerial photogrammetry to the mapping and inventory of forests and forest land. The field had made great progress as a result of military applications.

Each such development has generated a spate of short courses. In forestry, photogrammetry was followed by continuous forest inventory, prism cruising, use of herbicides, regeneration technology and systems, and, more recently, use of microcomputers, investment analysis, Federal income and estate tax applications, and computerized geographic information systems.

In the harvesting and forest-products fields, the timetable has been about the same. Subject-matter sequence (the order is not exact) has been kiln drying, gluing, finishing, sawmilling, wood preserving methods, log and lumber grading, statistical quality control, safety, cost control, use of microcomputers, and the development of export markets.

Technician-School Programs

In terms of resident teaching loads, many of today's technician-school faculties are about where those of Georgia, Louisiana State, and North Carolina State were in the 1930's. These people simply have no time for anything other than counseling students and teaching the regularly scheduled courses (Moser, personal communication).

Only 5 of the 14 southern programs contacted listed continuing education offerings. Two of these (Abraham Baldwin Agricultural College and Southeastern Community College) offered workshops for forest landowners on such subjects as forest regeneration, forest management, timber cruising, timber harvesting, and timber marketing (Brown, personal communication).

These plus three other institutions (Haywood Technical College, Dabney S. Lancaster Community College, and Lurleen B. Wallace State Junior College) offered short courses or night classes for technicians or workers in certain skilled occupations. Examples of subjects were sawmilling, lumber grading, dry kiln operation, and point sample cruising.

University faculty are paid primarily to counsel students, teach organized courses, conduct and write up research and, in land-grant institutions, plan and carry out extension programs. These are budgeted functions. Continuing education is a supported activity for extension faculty; otherwise it usually must be self-supporting from fees charged or "bootlegged" from the research or resident instruction budget.

There is a fifth function, which carries no budget line but for which faculty and administrators have an unwritten obligation. This is "service." Within the university this has involved serving on department, school, college, or university committees, the faculty senate, the athletic council, helping with alumni affairs, serving as marshals at graduation, and the like. It is an important but not always popular duty. But although it is a necessary part of making a university's wheels turn, it has little recognizable impact beyond the ivied walls of academia.

But "service" beyond the university often has been very important to the progress of forestry and forest industry in State and region. Such service is of two major types.

Service to the Profession

University faculty and administrators have been major

contributors to their professional and scientific societies and trade associations as officers, committee members and chairpersons, members of editorial review boards, writers for publications, program chairpersons, and speakers at meetings. Here are some significant examples from the South.

In Alabama, professor Wilbur DeVall, former head of Auburn's Department of Forestry, helped organize the Alabama State Board of Registration of Foresters in 1958. He served as its first chairman and has been a member of the board continuously since its founding. In Arkansas, the University's Department of Forest Resources has been represented continuously on that State's registration board. In other States, faculty and administrators have served frequently on such boards, which are charged with promoting and maintaining ethical standards for professional practice.

University forestry administrators have often been involved in policymaking for State forestry organizations. The president of Clemson University is an ex officio member of the South Carolina Forestry Commission. The director of the Louisiana State University School of Forestry and Wildlife Management is an ex officio member of the Louisiana Forestry Commission. The head of the Department of Forest Resources, University of Arkansas at Monticello, serves on the advisory board of the Arkansas Forestry Commission. At the University of Tennessee, the director and faculty of the Department of Forestry, Wildlife and Fisheries were extremely influential in getting legislation passed in 1984 creating the seven-member Tennessee Forestry Commission. The director currently represents the general public on this policy- and budget-recommending body. In Mississippi, a former director of Mississippi State's School of Forest Resources played a key role in the passage of legislation to create staggered terms for members of that State's Forestry Commission. This has provided for continuity from administration to administration not only for commission membership but also to a greater extent than before in the position of State Forester. The dean of the School at Mississippi State is a continuing member of the commission (Foil, personal communication).

The work of pioneer extension foresters in Arkansas and South Carolina in helping secure legislation establishing forestry commissions in these States has already been mentioned.

In the trade association area, the director of the School of Forestry and Wildlife Resources of VPI and SU led in the establishment of the Virginia Forestry and Forest

Products Council about 5 years ago, and served as its first chairman (Hosner, personal communication). School deans or directors are ex officio members of boards of directors of State forestry associations in Florida, Louisiana, and Mississippi. During hard times in the past, the Mississippi State School of Forest Resources has provided staff and other support to help keep the Mississippi Forestry Association in operation (Foil, personal communication).

Service to the Public

Southern universities have made and continue to make important contributions to public policy. They are qualified for this role by virtue of their being pools of scientific and technological expertise and relatively unbiased, reasoned judgment based on such expertise. Two examples will suffice to illustrate the university contribution to public policy.

Environmental protection came to the forefront as a public concern in the 1970's. A major dimension at the State level was the development and implementation of "Best Management Practices" to minimize nonpoint-source water pollution from forestry operations as required under section 208 of the Federal Water Pollution Control Act of 1972.

As discussed earlier, specific university research was initiated or was already underway in Arkansas, Florida, Oklahoma, Tennessee, and elsewhere on forest management practices/systems and water relationships. As a result, the university forestry-program units were able to supply data-backed evidence as to the nature, intensity, and duration of effects of forest management and harvesting practices and least-cost modifications for mitigation.

The availability of such evidence made it possible for one State's department of environmental regulation to agree to put compliance with guidelines on a voluntary basis (Mace, personal communication). In another State, such evidence—provided by the university to key leaders individually and at public hearings held throughout the State—was instrumental in preventing adoption of State legislation to restrict harvesting and other forest practices (Blackmon, personal communication).

Legislation authorizing assessment of forest and agricultural land on the basis of present use rather than "highest and best use" was adopted in a number of Southern States in recent years. University forestry faculty and administrators provided technical input in the drafting stage of these so-called Greenbelt Laws. But they played an even larger role in developing and maintaining systems for classification and valuation of forest land according to net

productivity value, particularly in Arkansas, Mississippi, and Texas (Lee and Richards, personal communications).

In Texas, for example, registration of forest land by owners under the present use assessment law is voluntary, not mandatory. But in the 37 East Texas counties, nearly 70 percent of the 10.5 million acres (4.2 million ha) of privately owned forest land have been so registered.

At the request of the Texas Property Tax Board, Texas A. & M. forest science faculty members Robert Baker, a remote sensing and forest valuation expert, and David Moehring, a forest soil scientist, worked together to develop a system for classification and valuation of forest land. Over the 37-county area, Baker used high-altitude aerial photographs to classify such lands by school districts into one of three forest types. Moehring used general soil group maps to develop four productivity classes equivalent to USDA Forest Service forest survey system site classes. Forest survey data were then used to develop estimates of average net growth per acre per year for each of the 12 type-productivity categories of the 3 × 4 matrix.

To establish the net earnings per year, the "Timber Mart South" private market newsletter was used as a source of yearly stumpage prices. Annual management costs were developed by surveying forest owners. Price and cost data have been updated annually as a basis for continual adjustment of capitalized values on a moving 5-year average basis.

Effects have varied. Owners with lands near urban areas have experienced tax savings. Owners of rural forest lands have sometimes had increases. But the overall effect has been a reduction of $2.00 to $4.00 per acre ($5 to $10 per ha), for an aggregate annual saving in the range of $14 million to $28 million (Baker, personal communication).

In early 1985, the South's higher education system for forestry and forest-products fields consisted of 15 public senior universities and 1 private senior university offering professional degree programs, and 14 public community, junior, or technical colleges engaged in educating technicians.

With one exception, the senior universities were involved not only in resident teaching leading to baccalaureate and advanced degrees but also in continuing education, research, and public service consultation. Twelve of the 15 public senior universities were land-grant institutions and, as such, had continuing responsibilities and programs in extension forestry and, in some cases, extension forest products as well.

The 14 colleges offering technician education were involved primarily in resident teaching. Only five were also involved in continuing education.

By 1985, a substantial majority of these programs met or exceeded established national standards for quality. Professional forestry degree programs at 15 of the 16 senior universities met accreditation standards of the Society of American Foresters. In addition to forestry, 10 offered professional majors or options in one or more forest-products fields such as forest engineering, wood utilization, wood science and technology, and, in one case, pulp and paper science and technology. In addition to baccalaureate programs, 13 universities offered graduate training at the master's level, and 11 of these offered Ph.D. degree or, in one case, the doctor of forestry degree in programs primarily to train scientists.

At the technician level, resident teaching programs at 8 of the 14 colleges met or exceeded Society of American Foresters minimum standards for forest technology programs.

Programs at the senior universities were characterized by extensive multidisciplinary collaboration across fields within the institution and, beyond it, with public resource-management and research agencies, professional and scientific societies, trade associations, forest-industry companies, private landowners, and consultants. This was particularly marked in the research, extension, and continuing-education functions.

In research, beginning in the mid-1950's, the southern senior universities pioneered in the establishment of university–industry–public agency research, development, and application cooperatives. By 1985 there were 20 of these at 9 of the 16 institutions. The cooperatives have proven highly effective in linking

researchers and users together in joint efforts with resulting rapid interpretation, application, and adoption of findings.

With the exception of the famous Biltmore Forest School in western North Carolina, which operated from 1898 to 1913, professional education programs got underway later in the South than in the North and Midwest. Consequently, many of the early southern foresters were educated elsewhere. Only 470 had received degrees from Biltmore and three other southern schools up to 1935. But in the next 50 years the southern schools came into their own—especially following World War II. Since 1935, they have graduated an estimated 18,600 professionals, of whom an estimated 60 percent have gone to work initially in the South. As of 1985, an estimated two-thirds of the southern membership of the Society of American Foresters with professional degrees were educated in the South. Graduate-level programs also expanded rapidly in the post-World War II period. The first Ph.D. in the south was granted in 1938, and 577 more have been awarded since then.

With the exception of the Lake City, FL, Forest Ranger School, which started as a private endeavor in 1947, technician-training programs were initated just in the past 20 years. Their development was stimulated in part by the Manpower Development Training Act of 1962, which made Federal funds available on a matching basis to help support vocational–technical training programs. To date, the 14 colleges with such programs have graduated nearly 3,900 technicians (primarily forest technicians). More than two-thirds are estimated to have entered a related job in the South.

Up to the early 1950's, teaching demands severely preempted the time of university forestry and forest-products faculty in the South. Yet extensive empirical research was carried out—first at Biltmore and then, in the 1930's, on university agricultural and forest lands at Auburn, Duke, North Carolina State, Clemson, and elsewhere. These were large-scale combination field research and demonstration programs on which long-term records are now available. The programs have been exceedingly valuable in establishing reforestation, silvicultural, and management guidelines and serving as result demonstrations of forest practice in extension-type education of landowners.

University forestry and forest-products research in southern universities and elsewhere received its greatest shot in the arm from passage of the McIntire–Stennis Cooperative Forestry Research Act in 1962. This act made Federal funds available on a matching basis

to expand research and the training of scientists. A comparison of 1968 research activities (the first year for which accurate records were available) with those of 1983 shows that university forestry plus forest-products research scientist-years increased 80 percent. The number of formal projects increased 50 percent, and total funding from all public and private sources for such research increased nearly 600 percent over that 15-year period.

In forestry, southern universities have made major research contributions in forest biology areas such as genetics and tree improvement, forest fertilization, nursery management, aspects of pest management, in biometrics, and in the development of acceptable practices for nonpoint-source pollution control. These are areas where there have been large-scale applications of results, and for which growth or profitability gains or loss-reduction effects are significant.

In forest-products fields, examples of major contributions include the development of harvesting systems to pick up waste biomass for use as fuel, improved kiln drying systems to cut drying times and losses due to degrade, utilization of soft hardwoods in manufacturing structural grade plywood, computerized custom pallet design system, and the use of oxygen rather than chlorine in the bleaching of pulp. Each has resulted in major savings in costs and/or material, or in new uses for previously unusable species, grades, or sizes of raw material.

The universities have made significant contributions in basic research areas such as nutrient cycling; insect biology, behavior, and population dynamics; the physiology of drought resistance; the physiology of infection and epidemiology of rust organisms; the liquification of wood; and, recently, tissue culture, gene splicing, and gene transfer.

The rapid expansion in southern forest industry, State forestry programs, research, and the pace of technological development after World War II mandated the expansion of continuing-education and extension programs. These have been the link between the university and the field through interpreting research into applicable and understandable forms; demonstrating new and better equipment, techniques, and systems with users under field conditions; publicizing results; and training professionals, key managers, and production personnel—people who train and motivate others by means of short courses, symposia, and institutes.

Continuing education involving teaching and research, as well as extension faculty, is primarily a post-World War II development. Extension forestry began earlier, in

the mid-1920's; but until recent passage of the Renewable Resources Extension Act of 1978 to provide earmarked Federal support, it operated on a very small scale in all but a few States. Even so, it made substantial contributions—initially in farm forestry primarily, but more recently in nonforest industry, private forestry generally, and in harvesting, processing, and utilization. And throughout its history, extension has been instrumental in attracting southern young men and women into forestry or simply training them in good forest stewardship through the 4-H program.

Recent major emphasis in extension programs has been on educating landowners, foresters serving them, and logging managers in financial anaysis of regeneration, management, and harvesting enterprises through use of microcomputers. Recent years have also seen emphasis on formation of county nonindustrial private forest owner associations to promote the interests of this ownership class, conduct educational programs, and share experience.

From the very beginning, southern university forestry and forest-products faculty and administrators have been substantially involved in the affairs of their own professional and scientific societies and with trade associations and conservation groups. They have served as organizers, officers, editors, reviewers, advisors, and authors.

They have also often made key contributions in the public policy arenas of the region and the individual States. Primarily they have served as objective sources and interpreters of scientific and technological aspects of issues, proposals, and programs to legislative bodies, other key elected officials, regulatory agencies, taxing and zoning authorities, and State forestry and other natural-resource protection and management organizations. Such contributions are made individually and often unofficially. For these reasons, they often go unrecognized. But they have been vital to the welfare of the forestry community as well as that of the larger public.

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